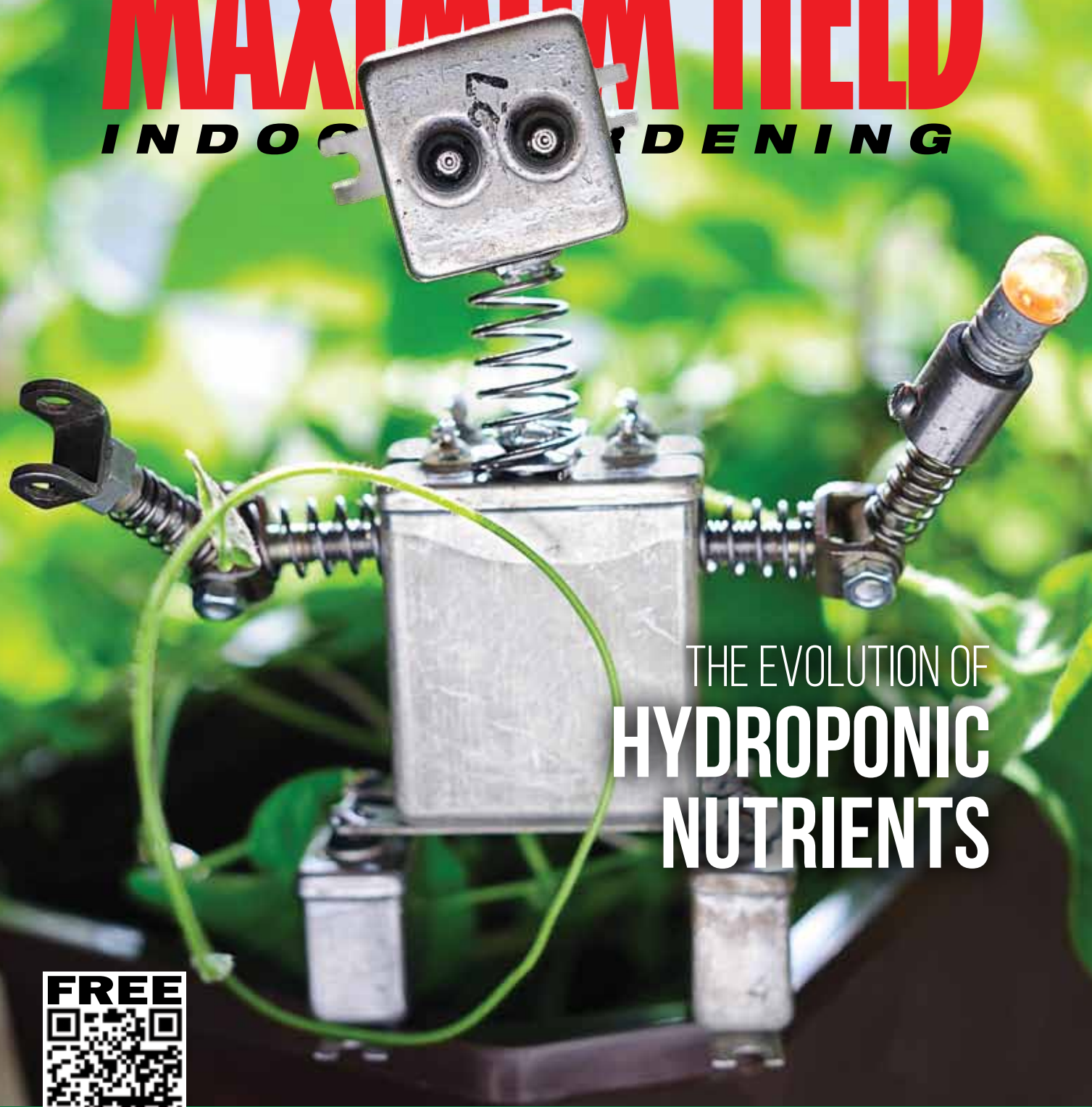


**INSIDE** HANDLING HARVESTS // LIGHT COVERAGE // HYDRATION // MORE

**AUSTRALIA** January - February 2015

# MAXIMUM YIELD

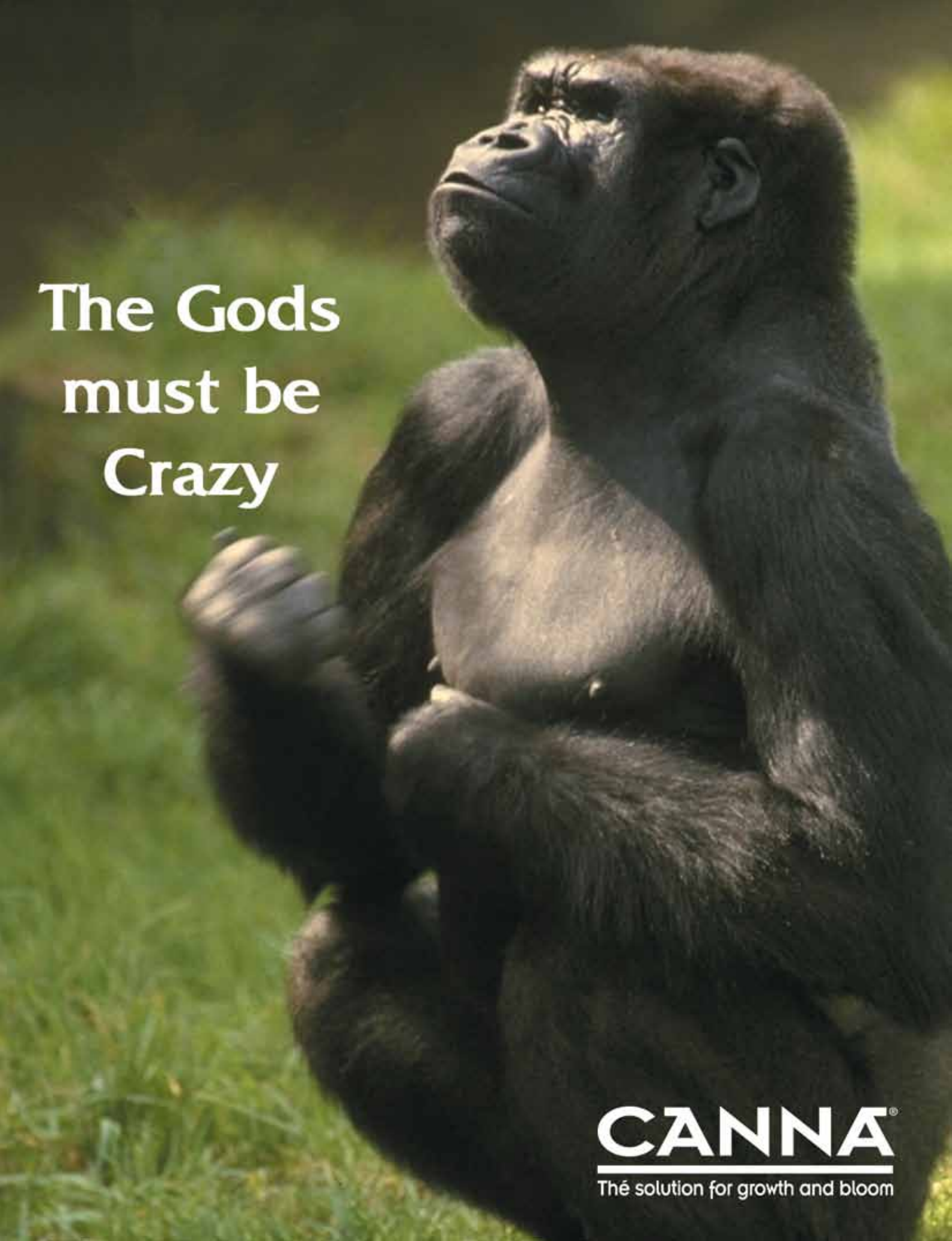
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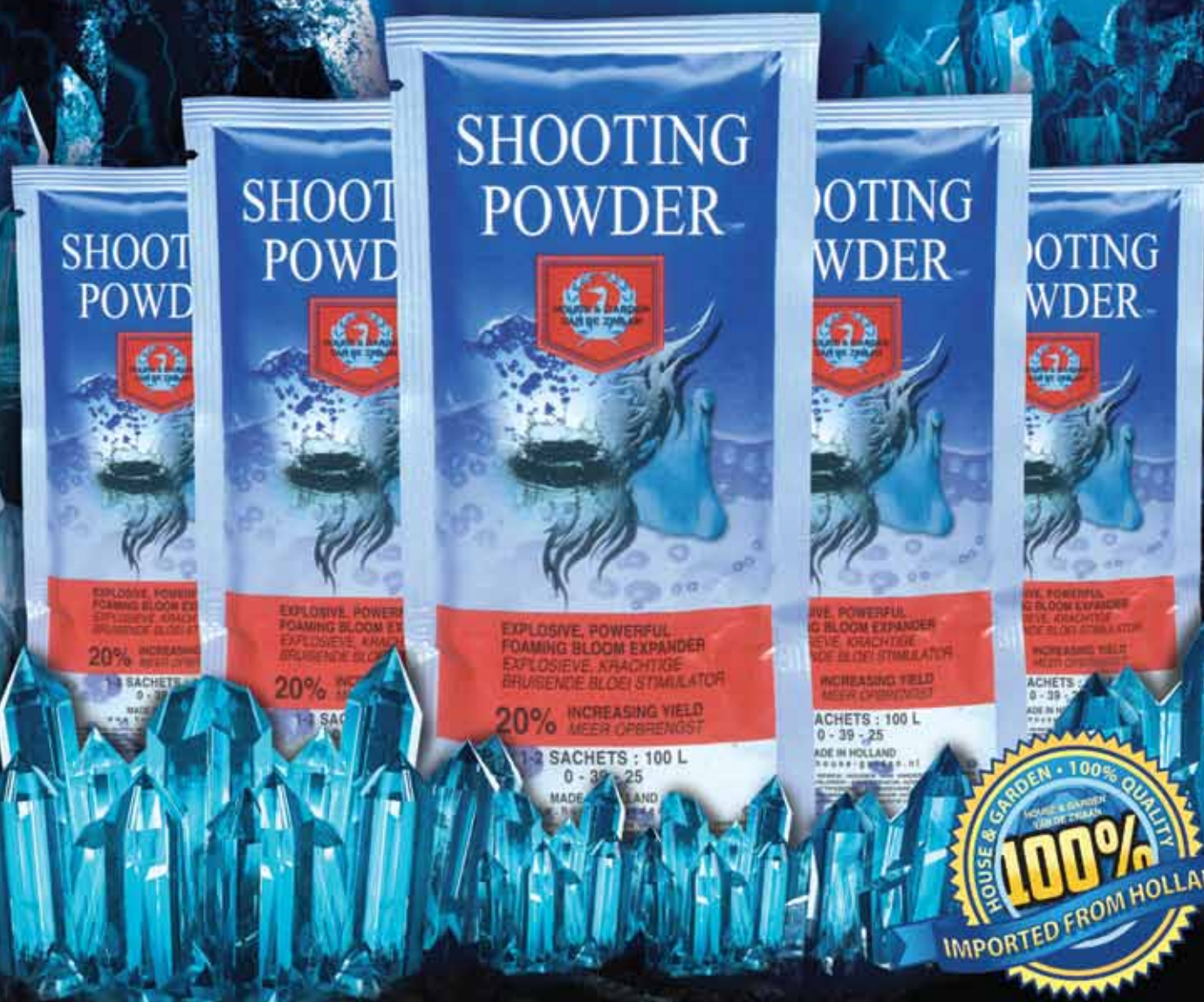
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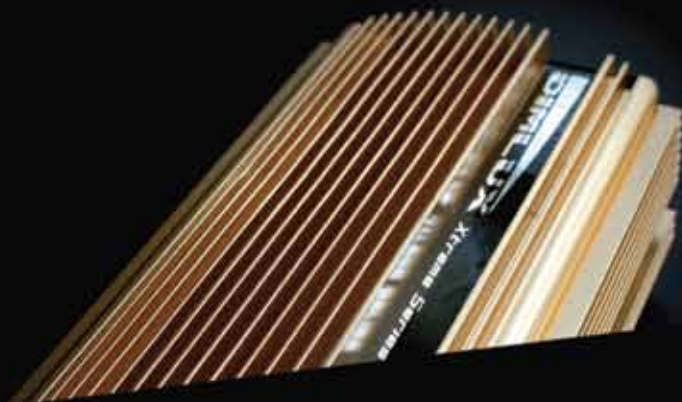
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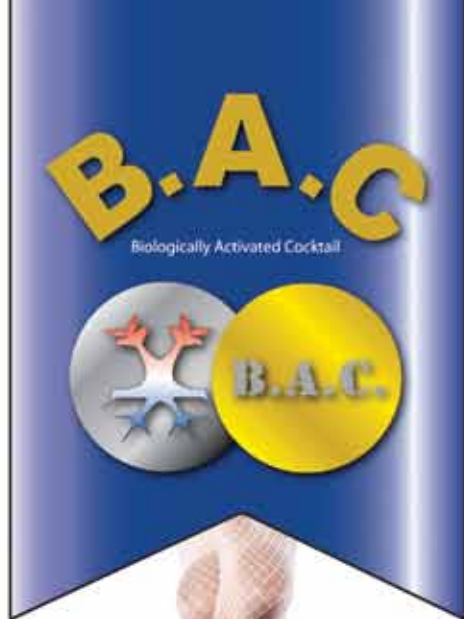
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## Message from the Editor

Linda Jesson

*Linda*

### Happy New Year from Maximum Yield!

January—a great time to make those New Year's resolutions. For most of you reading this issue, one resolution might be to grow a more fruitful garden this year! Well, we have everything you need to get started this month. With an indoor garden, you'll need to brush up on your horticulture lighting knowledge, as well as how it interacts with carbon dioxide levels, which we've covered in this issue.

Another important aspect of gardening is keeping things hydrated, which can be tricky in Australia's warm climates. Follow our 10 Best Watering Practices to ensure your plants are getting enough of the good stuff, and also check out why properly hydrating your cuttings is so important.

One of the best reasons to expand your garden indoors is to have a more abundant supply of fresh fruits and vegetables year-round, a great resolution we see many people making. The harvesting stage of indoor growing is the most rewarding stage. We cover a few methods of proper post-harvest handling to help you get the most out of your crops. From these harvesting tips, and our advice on lighting, watering and CO<sub>2</sub> enrichment, our first issue of 2015 is packed full of helpful tips and tricks to help you maximise your time spent in the growroom. Along with all of these tips and tricks, be sure to stay up-to-date on the latest technology, trends, trivia and products with our Product Spotlight and Max Facts sections. It's going to be a big year for indoor gardeners as the urban gardening industry continues to gain momentum.

We've got another full editorial lineup ready to go for the year, and the dates for the 2015 Grow Like a Pro Indoor Gardening Expo are also set—we've booked four great shows in three exciting new locations spanning from coast to coast in the United States, including Seattle, Washington, March 7-8; Chicago, Illinois, May 30-31; Los Angeles, California, July 25-26; and

Boston, Massachusetts, October 24-25. If you're planning a trip overseas, we sure hope you make plans to attend a show and see the latest growing products and technologies first-hand. More details can be found at [indoorgardenexpo.com](http://indoorgardenexpo.com).

*Wishing you all a Happy New Year and maximum yields!*

## CONTRIBUTORS



**Bill DeBoer** is a laboratory scientist at Indiana-based steadyGROWpro. A master gardener intern, Bill is responsible for the company's laboratory operations, including the design and execution of research projects, plant propagation, seed germination and overall plant care. Bill has a BS and MS from Purdue University, and was previously a research technician for the US Department of Agriculture.



**Dr. Lynette Morgan** holds a B. Hort. Tech. degree and a PhD in hydroponic greenhouse production from Massey University, New Zealand. Lynette is a partner with Suntec International Hydroponic Consultants and has authored several hydroponic technical books. Visit [suntec.co.nz](http://suntec.co.nz) for more information.



**Eric Hopper**'s past experiences within the indoor gardening industry include being a hydroponic retail store manager and owner. Currently, he works as a writer, consultant and product tester for various indoor horticulture companies. His inquisitive nature keeps him busy seeking new technologies and methods that could help maximise a garden's performance.



**Christopher Sloper** is the author of *The LED Grow Book*. His bachelor's degree in chemistry, MBA, ownership of two hydroponics stores and decades of gardening experience have taught him to question the status quo and experiment for himself when gardening indoors or out. Christopher would rather discuss the food meter than the food mile.



**Matt LeBannister** developed a green thumb as a child, having been born into a family of experienced gardeners. During his career, he has managed a hydroponic retail store and represented leading companies at the Indoor Gardening Expos. Matt has been writing articles for *Maximum Yield* since 2007. His articles are published around the world.



**Karen Wilkinson** is a budding gardener with previous experience working in the hydroponics industry. Her background includes daily reporting, technical writing, marketing and promotions. After spending years living along California's northern coast, she made her way to Sacramento where she currently lives and breathes the yoga lifestyle.

Become a *Maximum Yield* contributor and have your articles read by 250,000 readers throughout the US, Canada, UK, Europe, New Zealand and Australia. *Maximum Yield* is the largest free-to-consumer indoor gardening magazine in the world. Every issue is available on [maximumyield.com](http://maximumyield.com), which has thousands of unique visitors monthly.



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# LETTERS TO THE EDITOR

## Fans Write In and Win

*Maximum Yield* rocks! It features all of the industry's cutting-edge technology and always contains tons of information, especially for those who cannot make it to an Indoor Gardening Expo. I have been reading since the beginning. I have watched *Maximum Yield* grow and I believe it will continue to grow. I look forward to many more great issues in the future.

**Virna Trevino**  
22<sup>nd</sup> I'm a Fan Contest Winner



Virna Trevino

I'm a fan of *Maximum Yield* because it keeps me up to date on new products and growing techniques. I'm new to growing and maximising my growth potential is important, which is why I find your magazine to be a great help when it comes to finding the latest products.

**Damon Eversole**  
23<sup>rd</sup> I'm a Fan Contest Winner



Damon Eversole

Virna and Damon's answers to why they are fans of *Maximum Yield* have won them each a \$100 gift certificate to their favourite indoor gardening store. Are you a fan of *Maximum Yield*? You can win, too! Email [editor@maximumyield.com](mailto:editor@maximumyield.com) and tell us what you love about the magazine.

## Expanding Horizons

*Maximum Yield* has everything you could ever need to grow anything and has opened up my horizon on things I can do, such as growing different types of plants using different nutrients in different systems. I have learned so much from this book. I love getting the new issue and have just downloaded the new digital one.

TJ F.

## A New Generation of Growers

I just wanted to say how much I appreciate the magazine. I'm a 28-year-old production greenhouse grower and retail shop owner. My earliest memories are of the smell in the greenhouse, transplanting geraniums next to my grandpa, Bob. I'm looking forward to educating and supplying a new generation of high-tech indoor gardeners and wanted to give a personal thank you to the staff at *Maximum Yield*. Keep the inspiration and knowledge coming, your magazine is growing a new generation of producers. Keep up the great work.

Isaac Wiegmann

## Couldn't Ask For More

In *Maximum Yield*, I enjoy reading about the scientific processes behind the plants we love. The magazine is great, I couldn't ask for much more.

David L.

## TRENDING ON TWITTER

**Soulgarden Farm @SoulGardenFarm**  
Some recent #harvest deliveries. 50/50 hydro/outdoor using tips and tricks I picked up from the amazing @Max\_Yield



**Bren @BG\_garden**  
@kctomato I grew a Florida F1 a farmer friend gave me. It did well in drought. @inlightgardens @NikiJabbour @xitomatl @Max\_Yield @Violanursery

**NPK Technology @NPKTechnology**  
Enjoying @Max\_Yield

**Miami Hydroponics @miamihydro**  
@Max\_Yield @HydrofarmTV  
Congrats, Craig! The guy deserves the [Sales Rep of the Year] win!

**Smart Pots @SmartPots**  
Had a great time in #Boston. Thank you @Max\_Yield for a great time. See you next year.

# MAXIMUM YIELD

INDOOR GARDENING

VOLUME 12 - NUMBER 5

January/February 2015

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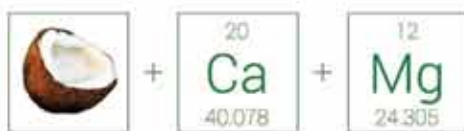
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**I'M INTERESTED IN STARTING AN INDOOR GARDEN IN THE NEW YEAR, BUT I'M WORRIED ABOUT THE COST OF SETTING UP A GROWROOM. DO YOU HAVE ANY TIPS ON HOW CAN I KEEP MY INITIAL COSTS DOWN, BUT ALSO SET MYSELF UP SO I CAN SAVE ON ELECTRICITY DOWN THE ROAD?**

**—NICK HEADLY**

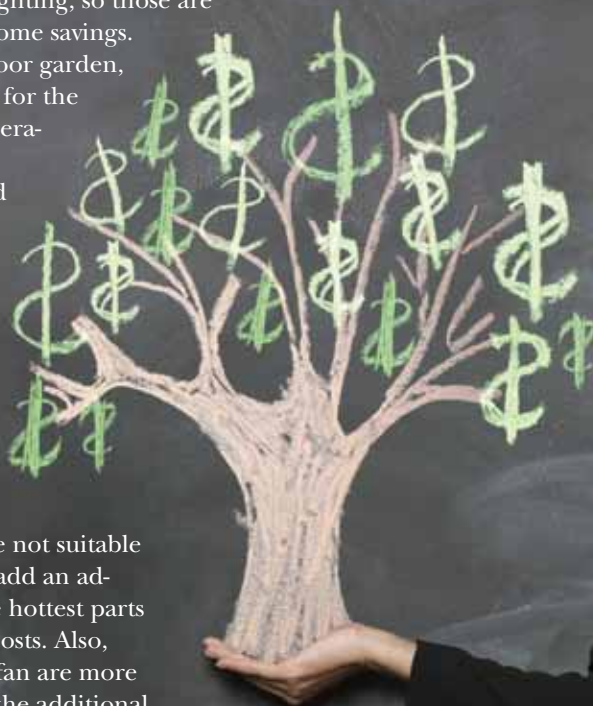
Thank you for your question, Nick. Most of your indoor gardening costs should come from a combination of environmental conditioning and artificial lighting, so those are logical places to start looking to make some savings.

When planning where to put your indoor garden, consider normal ambient temperatures for the area. An attic that already reaches temperatures of more than 40°C in the summer would require substantial insulating and air conditioning to be usable. A space that normally would stay at comfortable room temperatures is much easier to maintain as only the additional waste heat from the equipment has to be dealt with. While not always practical, running the lights during the cooler dark hours can be another cheap way to help with summer temperatures. Although their original cost is higher and they are not suitable for primary circulation, a solar fan can add an additional air circulation boost during the hottest parts of the day without adding to electrical costs. Also, while vented hoods with ducting and a fan are more expensive to set up than a naked bulb, the additional cooling means the lights can be closer to the plants and more efficient to run.

One way to save costs on indoor lighting is to supplement with natural lighting. Windows, skylights and even physically moving plants outside during the day can add kilowatts of additional light without increasing the electric bill.

As a final tip, prepare your garden with the assumption that there will be a liquid spill at some point. Removing carpets or laying down a protective plastic sheeting barrier to start with can help prevent water damage expenses in the event of an accident.

Planning is an important part of indoor gardening, and finding solutions for anticipated situations in advance can make a huge difference in the success and ease of indoor gardening.



*Peace, love and puka shells,  
Grubbycup*

*Grubbycup has been an avid indoor gardener for more than 20 years. His articles were first published in the United Kingdom, and since then his gardening advice has been published in French, Spanish, Italian, Polish, Czechoslovakian and German. He is also considered one of the world's leading authorities on crochet hydroponics.*





◆ Gavita Enhanced HPS 600W - 1100 UMC S-1

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Almost every HPS lamp is designed and built for a low frequency magnetic ballast. The low frequency doesn't put a lot of strain on the arc tube and the wire frame so construction can be kept relatively simple.

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## Spice Up Your Memory

Adding just one gram of turmeric to breakfast could help improve the memory of people in the early stages of diabetes and at risk of cognitive impairment. The finding has particular significance given that the world's aging population means a rising incidence of conditions that predispose people to diabetes, which in turn is connected to dementia. Early intervention could help halt the disease or reduce its impact. For the study, researchers tested the working memory of men and women aged 60 or older who had recently been diagnosed with untreated pre-diabetes. In the placebo-controlled study, subjects were given one gram of turmeric with an otherwise nutritionally bland breakfast of white bread. "We found that this modest addition to breakfast improved working memory over six hours in older people with pre-diabetes," says lead researcher Mark Wahlqvist, an emeritus professor at the Monash Asia Institute at Monash University in Melbourne.

(Source: sciencedaily.com)



# MAXFACTS

## GROWING TIPS, NEWS AND TRIVIA



## Figuring Out Fig Gashing

Do you have some unripe figs at home that you want to eat sooner rather than later? Try gashing them. When the fruit of the fig is pierced, or gashed, it causes the fig to produce ethylene gas. This gas helps the ripening process. Some people spray the fruit to induce ripening without piercing the outside surface of the fig. The gash can be anything from a small piercing like a pin-prick hole to a larger cut. As the fig ripens it expands, making the gash appear larger. Different types of pointed knives can be used to cut the skin. And because the ripening occurs due to the gas produced, gashing one fig in the vicinity of other figs helps them all ripen.

(Source: ehow.com)

## Developing More Salt-loving Plants

In an editorial submission to the journal *Trends in Plant Sciences*, researchers propose a new concept for breeding salt-tolerant plants as a way to contribute to global efforts for sustainable food production. "We suggest that we should learn from nature and do what halophytes, or naturally salt-loving plants, are doing: taking up salt but depositing it in a safe place—external balloon-like structures called salt bladders," writes Sergey Shabala, a professor at the University of Tasmania. Soil salinity costs the agricultural sector billions of dollars each year. Unfortunately, decades of plant breeding for salinity tolerance have not resulted in a major breakthrough that might resolve this issue. Sergey and his colleagues note that recent research on salt bladders creates the exciting possibility of modifying genes in traditional crops such as wheat or rice to allow them to develop salt bladders without majorly impacting their growth and yield.

(Source: sciencedaily.com)







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## The Language of Flowers

Back during Queen Victoria's rein, when Snapchatting or Facebooking wasn't an option, floriography, or the cryptological communication through flowers, was the chosen method amongst the well-to-do for sending secretive messages that were simply too offensive for delicate ears. Tussie-mussies, or posies, were like the emoji of the Victorian age. The small bouquets of flowers wrapped in a lace doily were a charming gift, but they also held enticing secrets in their foliage. They were enigmatic messages that could mean anything from, "I like your company," to "Let's get courting" or "Sod off." Flower meanings could differ wildly depending on where you lived, how you delivered them, what season it was, how you arranged them and, most importantly, what flower dictionary you used, leaving many young ladies in a state of anguish over guessing whether his posy of lavender was a declaration of admiration, or a gentle refusal.

(Source: [lifestyle.com.au](http://lifestyle.com.au))

## A New Grower's Handbook

Australian vegetable and potato growers now have a comprehensive listing of key Australian agribusinesses available at their fingertips, following the launch of the first AUSVEG Suppliers Guide. The Guide is an easy-to-use, one-stop directory for growers seeking information on service providers relevant to the day-to-day running of their businesses. "This resource is the latest initiative from AUSVEG to help growers access information that can be used to improve the profitability and productivity of their growing operations," says Lauren Winterbottom, AUSVEG spokesperson. "AUSVEG has identified a gap in the market for vegetable and potato growers and has produced a handy information source that can be kept in a glove-box, used at the office or viewed on the farm with any mobile device." From superannuation to crop protection to fertilisers to labour hire, it's all contained in the first print edition of the AUSVEG Suppliers Guide, also accessible online via the AUSVEG website.

(Source: [ausveg.com.au](http://ausveg.com.au))



## Berry Boom in Tasmania

Australia's growing appetite for berries is creating a booming industry for Tasmania. Berry production company Driscoll's has plans to double its Tasmanian operations to keep up with demand. This will see an expansion from 200 ha under production now to 400 ha over the next five years. Driscoll's Australia managing director Russell Allwell says the state's climate makes it the ideal location for berry production. The berry market in Australia is worth about \$600 million and is growing about 17% annually. Tasmania currently produces about 30% of Driscoll's strawberries and about 60% of its raspberries. The company also grows blueberries and blackberries in the state. "The summer berry production in Australia is under-represented," says Russell. "A lot of the strawberry production is based in Queensland over the winter and it's a summer fruit, so there's enormous scope for more summer strawberries to be grown, particularly in Tasmania."

(Source: [heraldsun.com.au](http://heraldsun.com.au))





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## CANNA

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## Peony Growers Make It Big

When Rodger and Cindy Whitson in Otago, New Zealand, decided to get into the cut-flower industry back in 2000, they started with a bare paddock and no horticultural knowledge. They trialled gentians, viburnum and peonies before deciding peonies were best suited to their property. Now, peony plant numbers have swelled from 2,000 to about 10,000, with plans for more plantings. The big, blowsy blooms are predominantly destined for the export market, with about 40% of the crop destined for the United States. The couple also sells a small number at the Otago Farmers' Market. Rodger and Cindy were able to turn their flower business, Janefield Paeonies, from a small- to a medium-sized commercial operation with the addition of a hydroponic system nine years ago. They use hydroponics to grow salad greens, herbs and microgreens to supplement their weather-dependent flower operation.

(Source: [odt.co.nz](http://odt.co.nz))



## Young Grower Wins Big

This year's Young Horticulturist of the Year is Patrick Malley from Northland, New Zealand. Representing Horticulture NZ, Patrick competed with five other finalists, all under the age of 30, in a final event that wrapped up days of competitions. Patrick co-owns a kiwifruit and avocado operation with his parents at Maungatapere and said he is excited about the future for horticulture. "There's going to be a huge amount of opportunity in the horticulture industry

in the years to come," he says. The project that led to his win is called Bin-Wise, which centres around how growers track and trace harvesting between orchards and pack-houses, and how that information flows right through to the retailers and consumers in the market where the fruit is sold. "It's using technology to try and get a really good, robust system that enables historical and real-time tracking of harvesting," says Patrick.

(Source: [radionz.co.nz](http://radionz.co.nz))

## Doubling Mango Exports

Australia currently exports between 4,000 and 5,000 tonnes of mangoes annually and is aiming to raise that number to 8,000-10,000 tonnes by targeting affluent consumers in key markets such as China, Korea and the United States, says Robert Gray, CEO of the Australian Mango Industry Association. "We're a producer of very high-quality, high-flavour mangoes, with relatively expensive production costs compared to Mexico or The Philippines," he says. The government is negotiating a deal with the US that will hopefully result in the first load of Australian mangoes heading there by February. Australia hasn't previously been able to export mangoes to China, Korea, the US or Japan because of fruit fly problems. "Developing protocols that those countries accept to treat the fruit prior to shipment so they don't have fruit flies on arrival has been the sticking point," says Robert.

(Source: [yahoo.com](http://yahoo.com))







## Millions of Sterile Fruit Flies Coming Soon

A new pilot project to rid Carnarvon, Western Australia, of the Mediterranean fruit fly (Medfly) is part of a suite of biosecurity projects for the state. Medfly costs the industry millions of dollars annually, targeting everything from citrus, mangoes and grapes to capsicums and chillies. Project manager Ernie Steiner from the Department of Agriculture and Food says the focus for the next 12 months will be around reducing the current fruit fly population through expanded baiting and trapping programs. Once monitoring confirms the desired reduction in Medfly numbers, a release of sterile male flies, which will be doused in fluorescent colouring to differentiate them, will commence. "Two days before they emerge as a winged adult, we sterilise them and ship them to our target area," explains Ernie, adding that once sterile flies are released, growers should notice a difference in the population within a couple of months.

(Source: [abc.net.au](http://abc.net.au))



## Food Waste Could Have Value

Queensland researchers are finding new ways to use components of waste produced by extracting healthy compounds to put into food and drink, animal feed and cosmetics. It's hoped to provide new markets for farmers and bolster food security. Ross Naidoo, a food science liaison officer with the Innovative Food Solutions and Technologies unit in the Queensland Department of Agriculture, Fisheries and Forestry, says the Queen Garnet Plum is rich in antioxidants and has by-products that could be more valuable than the plum itself. He also says the dark leaves of sweet potato crops could help fight fat. Anti-obesity components like phytochemicals, antioxidants and polyphenolics have been found to exist in plants, and when combined, Ross says they destroy or disrupt fat cells. The next step is to extract them and inject them into other products. A processing facility could be up and running by 2017.

(Source: [abc.net.au](http://abc.net.au))



# YOUR GUIDE TO THIS ISSUE'S HOTTEST ITEMS

Ask for them at your local indoor gardening store.



### SuperPonic BubbleFlow Bucket Systems

SuperPonic BubbleFlow Bucket Systems feature a proprietary upwelling technology and incorporate a hybrid of recirculating and deep water culture growing methods into one fully-automated yield machine. SuperPonics is defined as the fusion of proven hydroponic methods. Most bucket systems rely on gravity alone to fill their buckets, which causes the system to lack overall circulation. SuperCloset has eliminated this issue by pump-filling each bucket. Water is expelled from the reservoir by a high-capacity pump and forced into each bucket, causing tremendous upwelling. Water is then returned to the central reservoir through the unique addition of a second row of plumbing located near the top of each bucket. This provides unparalleled recirculation, creating an even environment in every bucket. This action, coupled with the oxygenation that takes place via in-bucket air stones, creates a rushing, river-rapid effect that takes plant growth to the next level. Choose between a 6-, 12- or 24-bucket system. For more details, visit your nearest grow store.

### BAC Foliar Spray

BAC Foliar Spray is a 100% organic solution that is sprayed onto plants to increase vigour and vitality through the activation of photosynthetic bacteria in and on the leaves. By doing this, chlorophyll production is increased and plants respond by growing quicker. Therefore, the time plants spend in the vegetative stage is reduced considerably, saving growers energy, money and time. BAC Foliar Spray, available in 120-ml bottles, also kills powdery mildew and botrytis on contact. In addition, the resulting increase in the starch content of leaves after spraying means spider mites and thrips no longer find plants suitable for their diet, and quickly move on! For increased vigour and vitality, remember BAC Foliar Spray. Prevention is far better than the cure. For more information, check out a local hydro store.



### Growlush CO<sub>2</sub> Generator

CO<sub>2</sub> generators are among the most cost-effective ways to add carbon dioxide to an indoor growing environment. Many greenhouses use CO<sub>2</sub> generators to boost CO<sub>2</sub> levels safely and economically. With new technology, Growlush has developed some of the safest and most-reliable CO<sub>2</sub> generators on the market that feature a pilotless, electronic ignition instead of the traditional pilot light and come with a standard tip-over switch that will shut down the fuel to the main burner in the event the unit falls or tips over. The PL-2 with two propane burners is recommended for areas up to 3 m by 3 m; the PL-4 with four propane burners



is recommended for areas up to 5 m by 5 m; and the PL-8 with eight propane burners is recommended for gardens up to 10 m by 10 m. Each installed burner adds approximately three cubic feet of CO<sub>2</sub> per hour. For more details, check out an indoor garden shop.

### Growlush Fan Speed Controller

At some stage throughout the year, you may experience colder conditions in your growroom. An easy solution to this problem is to use a fan speed controller to reduce the running speed of your inlet or outlet fan to help maintain warmer indoor temperatures. The Growlush Fan Speed Controller makes it simple to manually adjust and slow the running speed of any type of outlet or inlet fan. The unit is compact, easy to use and there is no wiring necessary. Simply plug the fan controller into the mains, plug the fan into the unit and adjust the dial to regulate the speed of the fan. The fan controller can also be used in conjunction with a Growlush Hot & Cold Dual Thermo Controller, a thermostat that plugs directly into the Fan Speed Controller to regulate the fan with even more control. For more information, visit an indoor garden shop near you.





## Dimlux Twin 315-W Full Fixture Light

The Dimlux Twin 315-W Full Fixture Light is the pinnacle of lighting innovation, giving plants the most complete lighting spectrum on the market today. An absolute marvel of technological engineering, this fixture comes with two Philips ceramic metal halide bulbs that are responsible for some of the largest harvest yields in agriculture on a gram-per-watt basis. The fixture's mirror-finished Alpha Optics reflector provides 98% reflection and operates on the single-bounce theory. It can be air-cooled, dropping ambient temperature by 5 degrees, and can be used in a vegetative setting to illuminate 4 sq m, leading to efficient flowering. The Dimlux Twin 315-W Full Fixture Light has a high micromole output and also comes with a dimmer switch that takes illumination from 380 to 760 W. For supreme agricultural lighting, remember Dimlux. Distributed in Australia and New Zealand by Dutch Bio-Power. Visit an indoor gardening store for more information.



## The Enhancer by TNB Naturals

Quickly becoming one of the most talked about products to hit the market, this highly-effective, user-activated CO<sub>2</sub> canister delivers a high rate of CO<sub>2</sub>, comparable to a costly CO<sub>2</sub> system. The Enhancer's unique features include its ability to slow the release of CO<sub>2</sub> during the night cycle, improving overall plant health and final yield. Store owners love its three-year shelf-life and growers are amazed at how the Enhancer generates one of the highest ppms in the all-natural category of CO<sub>2</sub> products. The Enhancer's ease of use—simply add water and shake—and the fact that it emits no heat makes it a top choice for knowledgeable growers. For more information, visit your local garden store.

## 10'x20' SuperCloset SuperRoom

SuperCloset's growprofessional 10'x20' SuperRoom is a King Kong of a growroom that offers only the highest-quality equipment. The SuperRoom is enclosed and protected by a height-adjusting 10'x20' Gorilla Grow Tent. The 10'x20' can be bundled with the grower's choice of an eight-light 600-W HPS lighting system or eight KIND LED K5 XL750s. The principle element of the 10'x20' SuperRoom is the 48-site Bubble Flow Bucket hydroponic system. The Bubble Flow Bucket system includes a combination of recirculating, upwelling and deep water culture. If you are looking to become a professional grower, the 10'x20' SuperRoom is your key to get in the game. Ask a local grow store for further details.



# PRODUCT SPOTLIGHT

## 10'x20' Gorilla Grow Tent

Gorilla Grow Tent is proud to introduce the massive 10'x20' Gorilla Grow Tent geared for commercial and professional growers, but also ideal for beginners. When encompassed by the 10'x20' Gorilla Grow Tent, growers feel like they are in a growroom, rather than just a grow tent. The tent's canvas is the thickest and densest with a 1680D thread density and is fire- and tear-resistant. Additionally, Gorilla Grow Tents are the only grow tents that come with a patent-pending height-extension kit. The size-optimisation design is framed by an all-steel pole structure. Gorilla Grow Tents come with spill pools, diamond-reflective walls, strong zippers, viewing windows, tool pouches and custom ports. When setting up your indoor garden this year, work with the tallest, thickest and strongest. Grow Gorilla. Grow Strong. For more information, ask for Gorilla Grow Tent at your local indoor gardening retail shop.



## BAC XSeed

BAC XSeed is a 100% organic solution that has been university-tested and verified to speed up and increase germination rates of seeds by at least 30%. BAC XSeed also protects seedlings from blights and diseases that can cripple and kill highly prized investments. By using BAC XSeed, growers give their seedlings the strongest, fastest starts possible. When combined with the rest of the BAC range, growers have the nutrients to grow the biggest and most productive plants ever. BAC XSeed is available in 10-ml sachets and 100-ml bottles. For the strongest, fastest seedlings, remember BAC XSeed. For more information, visit a local hydro store.



## Growlush Hot & Cold Dual Thermo Controller

The Growlush Hot & Cold Dual Thermo Controller allows growers to change



between a cooling thermostat and a heating thermostat with the flick of a switch. Cooling thermostats are often used with exhaust fans and/or other cooling devices. Set the desired temperature and the fan will turn on when the room temperature goes above this, and then off when it goes below. Heating thermostats are often used with heat pads. Set the desired temperature and the heat pad will turn off when the temperature goes above this setting, and then turn on when it goes below. The heating thermostat can also be used to turn a heater on until the room temperature reaches an ideal setting. The controller's waterproof probe makes it compatible for use in a nutrient solution as well. Simply place the probe wherever you want heat measured. For further information, visit an indoor garden centre near you.



## SolisTek Double-ended Lamps

SolisTek's high-output, double-ended lamps are designed to provide optimal plant growth and are now available in both high pressure sodium and metal halide versions. SolisTek's full line of double-ended MH lamps now offer growers the ability to supplement their gardens with a full-spectrum solution that enhances the health and the quality of their indoor garden yields. SolisTek's double-ended HPS lamps boast an incredibly high 2,100+  $\mu\text{mol}$  with incredible light and photosynthetic photon flux maintenance. The lamps are suitable for use with SolisTek double-ended digital ballasts and certified, ultra-high-frequency ballasts (100+ kHz). Check out an indoor garden retail shop for more information.



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# Handling Hydroponic HARVESTS

*Collecting a bountiful harvest from your garden is a wonderful experience. Nothing can beat the freshly picked taste of a ripe tomato, a crisp salad or the appearance of a bunch of perky cut flowers. An indoor garden can be very productive and oversupply can be common, which means that sometimes home-grown fruits, vegetables, herbs and flowers need to be handled and stored correctly.*



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At harvest, fresh produce is still a living product: respiration is occurring, using up stored sugars in the tissues, water is being lost from the surface, cell and texture, colour and firmness changes occur, ethylene may be released and pathogens such as moulds may start to grow. Higher temperatures speed up the rate of water loss from fresh produce, hasten shrivelling and increase the rate of ripening and softening. Any bruises or physical damage also increase the rate of deterioration and often promote decay of harvested fruits and vegetables.

What often confuses many gardeners about harvesting and post-harvest handling of fresh produce is that there are no general rules you can apply to all crops. For example, lettuce should be stored differently than tomatoes and the vase life of cut flowers can be prolonged significantly if they are treated right. As well, there are some things that just need to be eaten right away and not stored for later. Here is a guide to help you.

## LEAFY GREENS

These crops have a high surface area and moisture content and the main concern post-harvest is loss of water and shrivelling. Greens are best harvested when fully turgid and the foliage has the greatest water content. This is typically during

the coolest part of the day or the early morning. Microgreens need to be harvested when they are dry, as moisture on the foliage promotes rotting. Once harvested, the foliage should be cooled as quickly as possible. Washing in iced water can be used to cool lettuce before storage, provided excess moisture is removed afterwards. Greens, lettuce, wheatgrass and most leafy herbs should be stored in the refrigerator. The exception to this is basil, which is a cold-sensitive herb. Basil will discolour, go black and lose aroma and flavour if stored under refrigeration and needs to be kept at post-harvest temperatures above 8°C.

Herbs harvested to be dried are treated differently and should be harvested during the warmest part of the day when the foliage is driest. The lower the water content at harvest, the faster herbs will dry, ensuring a higher quality dried product, as herbs for drying need to have the moisture removed rapidly before any fungal pathogens have a chance to grow. Hanging them up in a warm, low humidity area with good air movement is the traditional method, although using a small dehydrator or oven on a low temperature setting are cleaner, faster and more accurate methods of drying herbs.

When harvesting leafy greens, plants to be cut should be carefully inspected and any that are diseased, mouldy or damaged should be discarded.



*"Whenever harvesting, the plants to be cut should be carefully inspected and any that are diseased, mouldy or damaged should be discarded."*

Left: Lettuces should be washed in ice water and stored in plastic under refrigeration.

Middle: Some vegetables, such as hydroponic asparagus, have a high rate of respiration and should be eaten within an hour of picking.

Right: Microgreens have a short shelf life due to their young, tender nature and rapid rate of moisture loss.



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## TOMATOES

The shelf life of tomatoes is highly genetic, meaning commercial growers produce hybrid cultivars with high firmness and a prolonged shelf life. However, home growers can produce the older, softer varieties since they don't have to withstand shipping long distances.

One common harvest problem with the smaller tomato types such as cherry and plum varieties is fruit splitting just after harvest. To help avoid this, split prone tomatoes are best harvested during the warmest part of the day when the water pressure inside the fruit is lowest. This helps prevent the skin from giving way. Maintaining a consistent and high EC in the root zone also helps prevent post-harvest splitting and improves the dry matter content of the fruit, thus improving flavour and firmness. Hydroponic tomatoes are best harvested vine-ripe, which means they have developed a good degree of colour while not being over-ripe. Harvesting and storing the fruit with the calyx still attached prolongs shelf life by restricting gas exchange. Make sure the calyx does not puncture the skin of adjacent fruit during storage.

Tomatoes, unlike lettuce and leafy greens, should not be stored in the fridge or at a low temperature because it destroys the flavour and texture of the fruit. Tomatoes are best stored in the fruit bowl at room temperature and eaten as soon as they are fully ripe.

## BERRIES

Like tomatoes, berries always have the best flavour if eaten directly from the plant while still warm. While berries

are typically stored under refrigeration to prolong shelf life, they will taste far better if eaten at room temperature before refrigeration, which allows for greater release of the aromatics that contribute to flavour than if eaten chilled. Fungal control pre-harvest is important for the post-harvest life of all berries. Diseases such as botrytis, if present in the growing area, can cause rots of the fruit in storage and need to be controlled before picking. Since berries have a short shelf life, ideally they should be picked and eaten within 24 hours.

## FLOWERS

During the growing process, potassium and calcium are vital for strong flower stems and bright, well-formed flowers and it is these elements that also help maintain shelf life after harvest. With cut flower species, it's important to harvest at the correct stage of flower opening. Some flowers will open further once cut, some won't, and in all cases, harvesting over-mature flowers will result in a poor-quality bloom with a short shelf life. Flowers are best harvested in the early morning, when the blooms will be most turgid and the cut stems placed immediately into clean, fresh, cool water. From there, depending on the species of flowers, they can be given a pulse treatment—a short period (24 hours) in a strong sugar solution immediately after harvest. While it's not useful for

*"Knowing how to correctly store your bounty means the time and effort invested in an indoor garden pays off with fresh and tasty produce year-round."*



Left to right: Cherry tomatoes prone to splitting post-harvest can be picked during the warmest part of the day; Tomato fruit should be stored in the fruit bowl at room temperature, never in the refrigerator; Nothing beats the taste of a freshly picked ripe, warm strawberry fruit; Soft, ripe berries are prone to post-harvest rots if pathogens are not controlled prior to picking; Hydroponic cut flowers can be pulsed with a sugar solution immediately after cutting to prolong vase life.





*"The correct harvest, post-harvest handling and storage procedures are great tools for maintaining the best flavour and quality of hydroponically grown produce."*

all species, a pulse treatment (at 1-10% sucrose in water) can prolong total shelf life in some flowers by up to three times. The sugar acts as a source of carbohydrate for the flowers since they are no longer attached to the plant and can't obtain any reserves from the leaves once cut. Once the pulse treatment is complete, the cut stems can be placed in a standard preservation solution that has a lower concentration of sugar and contains anti-microbial and pH correctors to maximise water uptake by the cut stems.

## FINAL THOUGHTS

The correct harvest, post-harvest handling and storage procedures are great tools for maintaining the best flavour and quality of hydroponically grown produce, but not all fruits and vegetables should be treated in the same way. Refrigeration may keep lettuce crisp and fresh, but it could destroy the texture and flavour of those perfectly grown hydroponic tomatoes. Knowing how to correctly store your bounty means the time and effort invested in an indoor garden pays off with fresh and tasty produce year-round. **MY**



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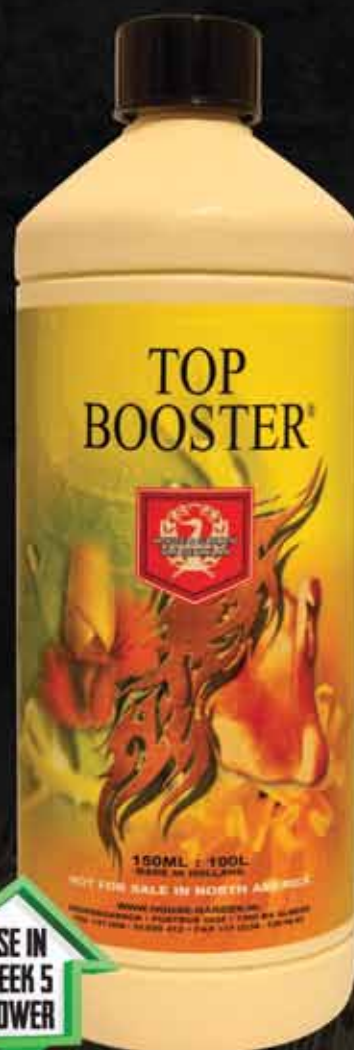
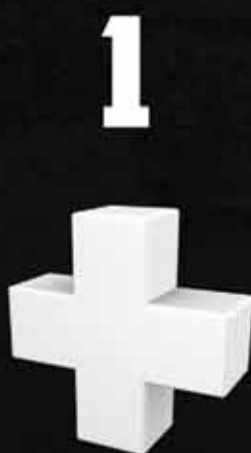
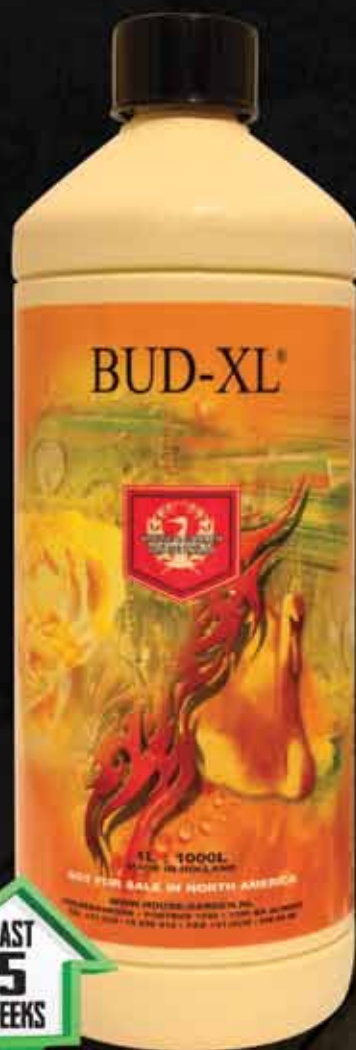
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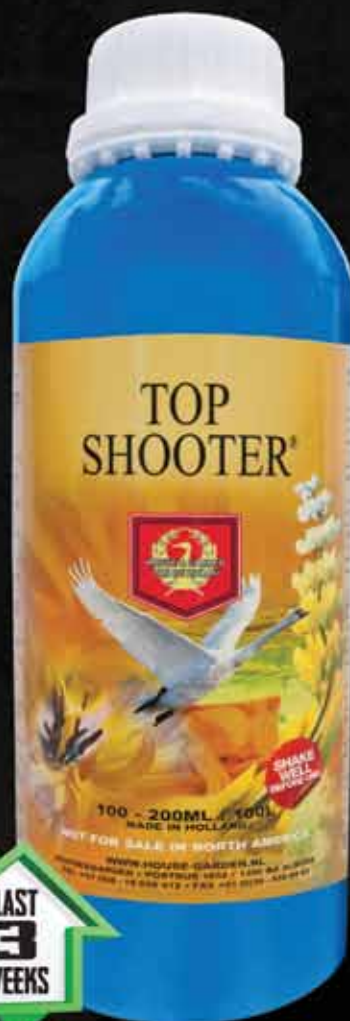
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# 10 Best WATERING Practices

**BY KAREN WILKINSON**

*Water provides the required hydrogen for plant growth and helps carry nutrients throughout the plant, but too much can prove deadly, and is one of the most common causes of death for indoor plants.*

There's no one-size-fits-all approach to watering—the amount and frequency of watering depends on the size of the pots and plants, as well as the amount of light. It may take a bit of experimenting to find the Goldilocks balance of just right between overwatering and under-watering, but once you've got that down, you can refine your technique and focus on other factors. While there are no hard and fast rules to watering—it really comes down to paying attention to a plant's specific needs—your judgment can determine whether you produce a healthy, bountiful crop, or one you'd avoid showing to your closest friends. With that in mind, here are a few watering tips to keep your plants in great shape.



### Check for Drainage

This sounds like a no-brainer, but it can easily be overlooked when growing in pots. Without proper drainage, excess water stays in the base of the pot, causing root rot. If the drainage holes are too small, create larger ones by using a knife or other instrument.

### Start With a Finger

Check the grow medium's moisture level with the handiest tool at your disposal—your finger. Feel the soil around your plants; ideally the top 5-8 cm are dry and the soil below is moist. If your garden is outdoors, check the weather forecast before watering.

### Timing is Everything

It's best to water during the start of the daily photosynthesis period. Watering in the morning provides the best environment for plants to absorb water, especially during warm weather before the hot sun or winds evaporate the moisture. This protects the plants from wilting in the afternoon heat. If mornings aren't manageable, try watering in the late afternoon, but not too late, as the foliage needs time to dry before the sun goes down to prevent the development of fungal diseases.

### Water Deeply and Sparingly

While seeds and seedlings need moisture close to the soil's surface, more established plants need the water to go deep to help develop roots that will go on to find water in the subsoil during droughts.

### Don't Go Overboard

You want damp soil, but there's a fine line between not enough and too much. Overwatering is one of the most common causes of plant death. Avoid having soggy soil 12-15 cm below the surface, as waterlogged soil can deprive roots of oxygen, which can lead to them losing the ability to uptake water. A sign of overwatering is foliage that begins to brown at the edges and falls from the plant. If that happens, take a step back and let the plants be.

### Humus Helps

Mixing in some hearty humus can provide water with something to hang on to until your

plants are thirsty. Depending on the type of soil used, more organic matter can increase the accessibility of water for your plants.

### Get the Water Just Right

Plants dislike water laden with chemicals and water that's too hot, too cold or distilled. The best way to prepare water is to let it stand in an open container for a few days before use, especially if the water is high in chemical content. Using water that's been sitting also allows it to reach room temperature, which prevents shocking the root system with warm or cold water. While using distilled or boiled water isn't harmful to plants, it doesn't contain certain beneficial chemicals needed for growth. Finally, make sure the pH is balanced.

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**“A SIGN OF OVERWATERING  
IS FOLIAGE THAT BEGINS TO  
BROWN AT THE EDGES AND  
FALLS FROM THE PLANT.”**

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### Catch the Rain

Plants love rainwater because it is rich in nitrogen and other elements. Rainwater is a great change in diet, especially for indoor plants.

### Check the Weight of the Pot

Lift each pot every time you water to get a sense of its weight. Pots are heaviest when the contents are moist, lightest when contents are dry. Over time this will become intuitive and you'll know when it's time to water based on the pot's weight.

### Pay Extra Attention During Flowering

You can positively influence a plant's potency by limiting the watering during this period. That said, you should check how long after watering your plants start wilting, and regularly water them one day sooner.

These tips are no replacement for common sense and regular maintenance, but keeping these things in mind will likely simplify the daily watering routine. **MY**





# Lights & CO<sub>2</sub> Pros & Cons

by Matt LeBannister

*CO<sub>2</sub> enrichment can dramatically improve your yields, but your choice of lighting can greatly impact the process. Read on to discover some of the pros and cons associated with different lighting systems and how they deal with elevated CO<sub>2</sub> levels in your garden.*



Carbon dioxide (CO<sub>2</sub>) is a hugely important component of the photosynthesis process and, therefore, overall plant health. This is especially true for rapidly growing plants. There is roughly 300-400 ppm of CO<sub>2</sub> in the air we breathe and growing plants can use that up quickly. Growth can dramatically slow when the CO<sub>2</sub> levels drop below 200 ppm. Enriching your growroom to 1,200-1,500 ppm of CO<sub>2</sub> is the logical next step to improve plant development. At this range, plant growth is accelerated as much as 2-3 times and crop yields can be increased by 20-30%. For CO<sub>2</sub> enrichment to be effective, growers must have all other aspects of their indoor gardens running perfectly.

One main factor that I have been asked about recently is lights and which style of lights are the best for gardeners using CO<sub>2</sub> enrichment. Here I offer some pros and cons regarding the most popular types of garden lights. Just keep in mind much of this is based on personal opinion. Each of the following varieties will do the job, some just better than others.



## FLUORESCENT

Fluorescent light bulbs come in a number of varieties. The most popular for gardens are the newer T5 high-output bulbs. They usually come in banks of two or more and are generally 60-120-cm long.

### PROS

Fluorescent light bulbs create even lighting and can be positioned all around the garden, even vertically. They can be placed close to the leaf canopy, are low wattage, saving you some money on your electricity bill, and are low heat.

### CONS

The fact that they are low heat can be a bad thing when enriching your growroom with CO<sub>2</sub>. Plants benefiting from CO<sub>2</sub> enrichment can tolerate higher temperatures and actually prefer it. A room temperature of 28-29°C will boost the metabolic rates of the plants and speed up growth.

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**ROUGHLY 300-400 PPM OF CO<sub>2</sub> IN  
THE AIR WE BREATHE AND GROWING  
PLANTS CAN USE THAT UP QUICKLY."**

Rapidly growing plants, especially those boosted by CO<sub>2</sub>, need as much light as possible. Fluorescent lights, even T5s, are not intense enough to really maximise the benefits of the extra CO<sub>2</sub>.

Replacing fluorescent bulbs and changing them for different stages of growth—bloom and vegetative—can be costly. After a year of use the lumen output of these bulbs will have dropped dramatically. In my opinion, fluorescent bulbs are not ideal when enriching your garden with CO<sub>2</sub>.

## LEDs

LED stands for light-emitting diode. LEDs are relatively new to the market and are no doubt the future of indoor gardening.

## PROS

LEDs use an extremely low amount of electricity. They also give off next to no heat and can safely touch the leaf canopy without the risk of burning. LEDs can last upwards of 10 years without requiring replacement.

## CONS

There are downsides to using LEDs in CO<sub>2</sub>-enriched gardens. LED light fixtures are not really available in larger sizes yet and most CO<sub>2</sub>-enhanced gardens are at least 3 m by 3 m. It is really hard to regulate the amount of CO<sub>2</sub> in a space any smaller than that and most LEDs on the market today are really only suited for 1.2-m by 1.2-m spaces.

The spectrum on most LEDs are neutral and not interchangeable for the bloom and vegetative stages of plant growth. However, newer fixtures that provide a wider spectrum are continually being developed, which provide an answer to these cons. LEDs are also low heat which, as mentioned with fluorescent lighting, can hinder plant growth.

There is no doubt in my mind that LEDs are the future of indoor gardening and will someday replace all types of gardening lights, but right now I feel like they are still unproven. That, coupled with their lack of heat and intensity, mean they are not ideal for CO<sub>2</sub>-enriched indoor gardens unless they are set up in large arrays.



## HIDS

High intensity discharge (HID) is a broad term for metal halide (MH), high pressure sodium (HPS) and mercury lamps. They come in a variety of strengths and spectrums.

## PROS

A 1,000-W HID bulb can cover an area as large as 2.4 m by 2.4 m or higher. You can interchange MH bulbs for the vegetative stage of plant development and HPS for the bloom stage of plant development, maximising the PAR watts within each spectrum. This is also cost effective compared to fluorescent bulbs, especially when you consider the digital ballasts available that can fire both MH and HPS bulbs.

HID bulbs do give off considerable heat, but this can be beneficial for plants being enriched with CO<sub>2</sub> as they do best around 28-29°C.

## CONS

High levels of heat can be detrimental if it causes evaporation of the nutrient solution in your reservoir. This can cause the nutrient levels to become too concentrated, leading to nutrient toxicities and leaf burn. One must be vigilant and constantly check and maintain the ideal nutrient-to-water ratios.

HIDs need annual replacement to maintain high lumen levels and spectrum. They are high-wattage lights so you will spend more on electricity than the previously mentioned alternatives.

In my opinion, HIDs are still the go-to light when enriching your garden with CO<sub>2</sub>. They are tried and tested, have the heat the plants will crave and are intense enough to efficiently cover larger areas. All of these lights will work fine when adding CO<sub>2</sub> to your garden. My choice of HIDs over fluorescents and LEDs is largely based on personal opinion and anecdotal evidence. Don't be afraid to try things out for yourself or consult your local hydroponic retailer for their expert opinion. **MY**

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# WHAT'S YOUR HYDRATION STATUS? by Bill DeBoer

EXAMINING THE HYDRATION  
STATUS OF SOFTWOOD AND  
SEMI-HARDWOOD CUTTINGS

*Proper hydration is paramount to an individual's success rate with cuttings. Softwood cuttings are especially sensitive, but semi-hardwood cuttings should be regarded as well. Here is Bill DeBoer with some good tips on how and why to rehydrate those precious, delicate cuttings.*





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**“A CUTTING EXPERIENCING WATER STRESS OR LOWER HYDRATION WILL HAVE A SMALLER CHANCE OF ROOT FORMATION RELATIVE TO ONE THAT IS FULLY HYDRATED.”**

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Most green thumbs who propagate plants by cuttings are concerned with relative humidity, temperature, rooting hormones and media type. While all of these factors play an integral role in the success or failure of rooting, there is one factor that growers may be overlooking: water status. It is so simple and ambiguous that I would argue it is rarely, if ever, addressed by the propagator. So, why do we care about how much water is retained in cuttings? In the case of softwoods, and to a lesser extent

semi-hardwood cuttings, proper hydration will directly impact turgor pressure. When the turgor pressure of a softwood cutting is high (in hydrated plants), the cuttings will feel rigid. Cuttings with low turgor pressure (as a result of water stress) will have a soft feel and will be noticeably wilted. A cutting experiencing water stress or lower hydration will have a smaller chance of root formation relative to one that is fully hydrated. Let's explore some reasons why proper hydration is so important to the success of root formation on cuttings.

## NO ROOTS AND LEAVES? WE MAY HAVE A PROBLEM

Roots are a plant's organs that take up water and nutrients. A combination of water and nutrients is pulled up the plant through the evaporation of water from the leaves. Therefore, a plant's cuttings will pump water out and become desiccated quickly. Water stress will lead to biochemical signalling events that can partition energy away from reserves that would go toward root formation. In addition, the stress response can lead to the abscission or dropping of leaves in an effort to reduce water loss. Collectively, both factors will significantly reduce the odds of successful root formation.

## LEAF ABSCISSION

If the leaves are the source of water loss, why should it matter if they drop off? Won't that help reduce water stress? Plants are certainly adaptable to certain stressors, and dropping leaves is a natural response to water stress. But things are not so black and white when we are dealing with a section of a plant. As you might already know, a plant's main energy source (sugar) is produced in the leaves by using light energy, carbon dioxide and water. Eliminate the energy-producing factories and the cutting will not have sufficient reserves to manufacture roots. Total failure will result. While having photosynthesis running on all cylinders is disadvantageous due to nutrient requirements (no roots to take them up), you do not want a complete shutdown either.

## STRESS IS COSTLY

To ensure the highest probability of successful rooting of plant cuttings, a grower must minimise energy sinks and water loss while promoting factors leading to root formation. Water is a lifeline to all levels of proper plant health, and water stress can be viewed as a decline in health. Think of the times when you are fighting a cold. How energetic do you feel, and how well do you perform other tasks? In this example, your body is



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expending considerable resources trying to fight off these invaders. Water stress will cause a slowdown or cessation (during prolonged and extreme drought conditions) of a plant's metabolism or the biochemical reactions needed to sustain normal functioning. Maintaining adequate hydration throughout the rooting process will reduce these negative events. Fortunately, there are ways to level the playing field and make sure all your cuttings start off on the right foot.

#### HOW TO REHYDRATE

Is simply placing the cuttings in a beaker of water enough? That may be adequate, but let's look to the world of the florist to understand what factors will help promote fast, efficient water uptake. Cut flowers are often treated with hydration solutions. A hydration solution may contain any or all of the following chemicals: water, an acid, a germicide and a surfactant. The role of water is obvious, while acids have a two-fold purpose. Lowering the pH level to between 3 and 5 facilitates an opening of the conductive tissue (xylem/phloem), as blockages to the xylem will greatly slow down or completely block water uptake. To this end, make sure you re-cut each plant cutting underwater so an air embolism or bubble does not form. Lowering the pH also helps to reduce microbial growth, which may or may not be paramount in this application. Next, a germicide will help sanitise microbes that have colonised the cut end or stem of the cutting. Using a germicide may provide dividends down the road in preventing fungal or bacterial infection that can rot the cutting. Lastly, a surfactant may accelerate the speed of water uptake by reducing surface tension. While this may help, I personally don't believe it is necessary for rehydrating plant cuttings.

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**"PLANTS ARE CERTAINLY ADAPTABLE TO CERTAIN STRESSORS, AND DROPPING LEAVES IS A NATURAL RESPONSE TO WATER STRESS. BUT THINGS ARE NOT SO BLACK AND WHITE WHEN WE ARE DEALING WITH A SECTION OF A PLANT."**

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#### HOW LONG TO WAIT

While there are significant anatomical differences across plant species, the total length of the cutting will be the largest determining factor in determining how long rehydration will take. As a general reference, a 5-7-cm cutting should fully rehydrate within 15-30 minutes.

#### IN CONCLUSION

Proper hydration is paramount to an individual's success rate with cuttings. Softwood cuttings are especially sensitive, but semi-hardwood cuttings should be regarded as well. The purpose of this article is to stress the

importance of maintaining proper hydration of plant cuttings. If a plant is fully hydrated, subsequent rehydration will be of little use. Remember, the role of water in cuttings is multidimensional. Water accumulation within plant cells exerts pressure against the cell wall, which creates the rigidity that keeps a plant upright. Loss of water pressure due to dehydration leads to wilting. Since cuttings do not have roots to uptake water, and a callus will eventually block uptake from the cut portion, the leaves will quickly become a major source of water loss, resulting in wilting and failure of the cuttings to root.





“WHILE SOME CUTTINGS WILL RESPOND FAVOURABLY TO SIMPLY BEING IMMersed IN WATER FOR REHYDRATION, OTHERS WILL BENEFIT FROM THE ADDITION OF AN ACID OR A SURFACTANT TO KEEP THE CONDUCTIVE TISSUE CLEAR AND TO ACCELERATE WATER UPTAKE.”

Stressors like dehydration can promote undesirable consequences like leaf abscissions that will also decrease root formation. Stress is metabolically costly in that the partitioning of resources to alleviate the stress will ultimately be taken away from the energy pool needed for rooting. While some cuttings will respond favourably to simply being immersed in water for rehydration, others will benefit from the addition of an acid or a surfactant to keep the conductive tissue clear and to accelerate water uptake. Even though they are not commercially available, rehydration solutions for cuttings could offer a potential vehicle, reinforcing leaves and thereby reducing leaf drop as well as delivering water-soluble compounds promoting root initiation.

While the traditional factors of relative humidity, temperature, rooting hormones and media type are important when it comes to growing using cuttings, make sure those thirsty cuttings are also fully hydrated, and you will be happy with the results. **MY**

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# THE EVOLUTION

OF HYDROPONIC NUTRIENTS

BY ERIC HOPPER

OVER THE LAST  
DECADE OR SO,  
THERE HAS BEEN  
A LOT OF  
DEVELOPMENT  
THAT HAS  
INFLUENCED THE  
WAY WE VIEW  
HYDROPONIC  
NUTRIENTS.  
EVER WONDER  
WHY THAT IS?



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Indoor gardeners have witnessed many technological advancements over the last few years. While strolling through almost any indoor gardening retail store, growers see various new lighting technologies, state-of-the-art atmospheric controllers, complex, ready-to-use hydroponic systems and ventilation and filter equipment. As a hydroponic store owner, I witnessed many new customers walk in and quickly become mesmerised by the various high-tech gadgets. These newcomers did not even realise they were walking right past some of the most incredible advancements in the industry. This is because these products didn't have flashing lights or colourful boxes. Although many have fancy labels, all are destined to be stored in a plain container on a shelf with many other plain containers that appear no different at first glance. I am, of course, talking about the bottles containing hydroponic nutrients that line the walls of the local hydroponic store.

Growers often walk by bottles of nutrients as they gaze at the latest and greatest inventions to hit the indoor horticulture market because nutrient bottles lack a certain satisfaction that only a tangible object can give. I am not saying that gardeners don't understand the importance of using quality nutrients, but sometimes the development of those nutrients is taken for granted. After all, hydroponic nutrients, like indoor gardening hardware, have evolved immensely over the last 10 years. There have been major breakthroughs in the methods used to extract, create and culture various nutrients and supplements. Nutrient manufacturers are paying closer attention to the way their products interact with each other.

In other words, more attention is being placed on how combining nutrients affects the end nutrient solution. Manufacturers are paying closer attention to the habits of the growers as well, which influences the way hydroponic nutrients are designed. There have also been major discoveries regarding the microscopic world in and around the plant's root mass. These discoveries have had a tremendous impact on the evolution of hydroponic nutrients. Many hydroponic nutrients

**"NUTRIENT MANUFACTURERS ARE PAYING CLOSER ATTENTION TO THE WAY THEIR PRODUCTS INTERACT WITH EACH OTHER."**

and supplements now include beneficial micro-organisms in their formulation. Over the last decade or so there has been a lot of development that has influenced the way we view hydroponic nutrition. Each of these developments deserves its own recognition as being a major contributing factor in the top-notch fertilisers available to today's indoor grower.

### CHELATED PLANT NUTRIENTS

One of the discoveries that greatly affected the hydroponic nutrient industry was the invention of chelated nutrients

for plants. Many growers use fulvic and humic acids because of their ability to chelate organic compounds and aid in nutrient absorption.

Scientists figured out a way to take this naturally occurring phenomenon and re-create it in the laboratory. This occurred in the early 1990s and since then, this discovery has changed the way our plants take in nutrients, especially micronutrients. The process of chelation describes a way that particular ions and molecules bind with metal ions. Many of the essential micronutrients found in a plant's diet are metals that, when chelated, can be absorbed more easily and used more

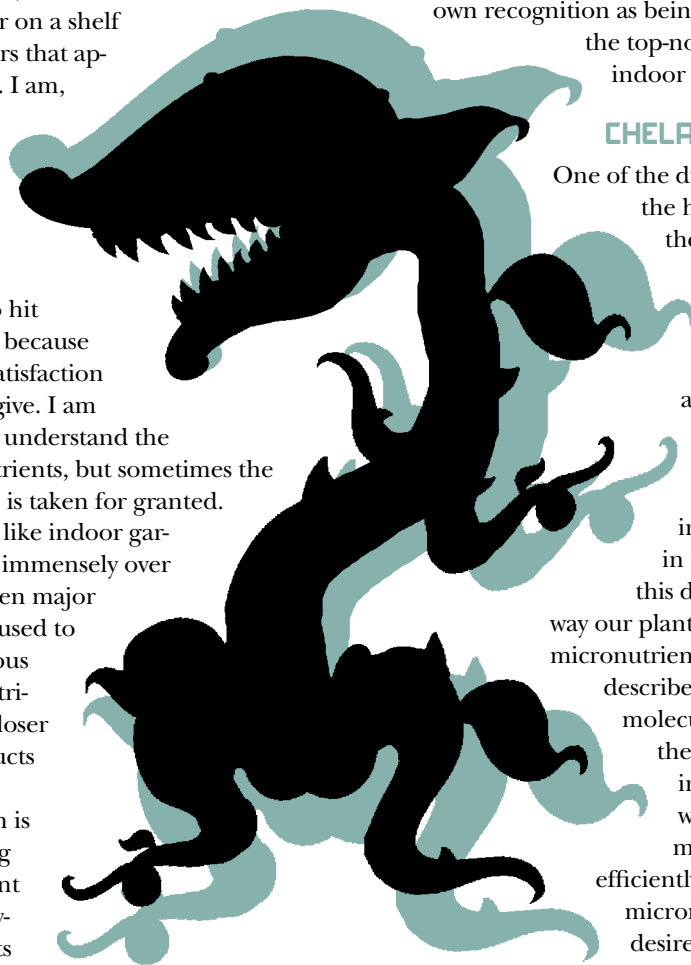
efficiently by the plant. To create chelated micronutrients for hydroponics, the desired micronutrient is combined with fulvic acid, ammonia and hydroxy acid, and in some cases heated until the

desired metal chelates form. After the chelates are formed, a stabiliser is added and the chelated nutrients can be added as an ingredient to a fertiliser or supplement. Chelated plant nutrients are stable and can be used in any hydroponic system, including high oxygen systems like aeroponic or top-drip systems. Chelated nutrients can also be used effectively in a foliar feeding program.

**"ONE OF THE DISCOVERIES THAT GREATLY AFFECTED THE HYDROPONIC NUTRIENT INDUSTRY WAS THE INVENTION OF CHELATED NUTRIENTS FOR PLANTS."**

### pH STABILISERS

Few parameters affect nutrient uptake in a hydroponic system as much as the





solution's pH. In fact, there is a desired pH range that hydroponic gardeners must stay within for their plants to uptake nutrients at all. One of the biggest frustrations for hydroponic gardeners is the constant battle trying to stabilise the nutrient solution's pH. Nutrient manufacturers are starting to understand that creating a pH-stable product is as important to creating success for the hydroponic grower as anything else. Some nutrient manufacturers have begun to add pH stabilisers to their nutrients to help curb undesired pH fluctuations. Other nutrient manufacturers are constantly testing and reformulating their products so they work synergistically without causing pH stabilisation issues.

**"SOME NUTRIENT MANUFACTURERS HAVE BEGUN TO ADD pH STABILISERS TO THEIR NUTRIENTS TO HELP CURB UNDESIREd pH FLUCTUATIONS."**



## AMINO ACIDS

Amino acids are essentially the building blocks of plant life. They are required for virtually every plant function to occur and are directly linked to a plant's metabolism. Many amino acids are produced by the plants themselves and contribute to the synthesis of cellular molecules, including chlorophyll. Plants grown in less than desirable conditions experience stresses that cause amino acid production to be hindered, which, in turn, causes stunted growth or reduced yields. By supplementing amino acids, a grower can help to negate the effects of many of the everyday stresses that may occur in an indoor garden, before they affect the plant. Hydroponic nutrient manufacturers are not only adding amino acids to many fertilisers, but are also creating specific amino acid supplements so the grower can add them as needed or desired. It wasn't necessarily the discovery of amino acids themselves that influenced the evolution of hydroponic nutrition, as much as the discovery of how to effectively extract the desired amino acids. Enzymatic hydrolysis

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extraction of amino acids is one of the most influential discoveries to affect plant health in hydroponic systems. It allows for the separation and concentration of L-form amino acids that can be used to amend existing fertilisers or create powerful stand-alone additives.

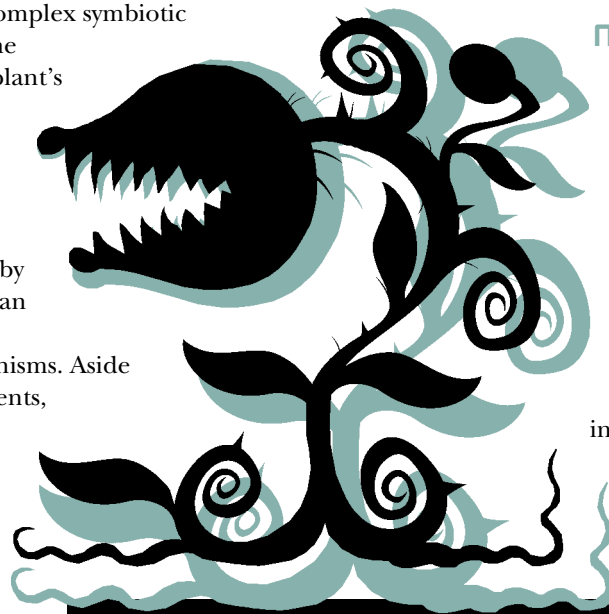
### BENEFICIAL MICRO-ORGANISMS

Our further understanding of the complex symbiotic relationships between a plant and the micro-organisms living around the plant's roots has played a pivotal role in shaping modern hydroponic nutrition. Some of the hydroponic nutrients are broken down into a readily available form and actually bypass the need to be broken down by a micro-organism. This does not mean that the plant does not benefit from supplemental beneficial micro-organisms. Aside from aiding in breaking down nutrients, micro-organisms stimulate root growth and defend a plant's root zone from pathogens. Many hydroponic nutrient companies offer micro-organism supplements. These can range greatly and be either specific (sometimes containing one particular strain or one type of micro-organism for a specific purpose or benefit) or more generalised (containing a mix of various micro-organisms for a more general benefit). Micro-organisms used for indoor horticulture can be broken down into three categories: mycorrhizae, trichoderma and bacteria. Each category contains many individual strains or varieties that can have varying benefits to plant growth. Each discovery made regarding these beneficial microbes and how they interact with plants (and each other) has contributed to our current understanding of plant nutrition and will contribute to the future of hydroponic nutrients.

### ENZYMES

Enzymes are specialised catalysts responsible for numerous chemical reactions happening in and around a plant at all times. Catalysts are substances that accelerate the rate at which a chemical reaction occurs. Enzymes, like other catalysts, are able to increase the rate of chemical reactions by lowering the energy required for the reaction. What makes enzymes different from other catalysts is their selective nature—enzymes only react with one particular substrate. Some of the specialised reactions created by enzymes are of great interest to the indoor grower. Root stimulation and breaking down organic matter (dead root matter) are probably the two most

common reasons indoor gardeners use enzymes in a hydroponic system. Enzymes have become intertwined with many fertiliser regimens so growers could be using enzymes and not even know it. Some nutrient manufacturers sell enzyme formulas for a specific purpose, such as controlling or treating pythium, or for more generalised supplementation, such as root stimulation or maintaining root health.



### NANOTECHNOLOGY

One of the newer technologies sure to influence hydroponic nutrition in the future is nanotechnology. Nanotechnology is the manipulation of matter at the atomic and molecular level. It is possible that some day all of our hydroponic fertilisers could be greatly influenced by this type of technology. The future uses of nanotechnology in indoor horticulture could include improving the plant's ability to absorb nutrients and the molecular treatment of diseases and pathogens.

**“THE FUTURE USES OF NANOTECHNOLOGY IN INDOOR HORTICULTURE COULD INCLUDE IMPROVING THE PLANT'S ABILITY TO ABSORB NUTRIENTS AND THE MOLECULAR TREATMENT OF DISEASES AND PATHOGENS.”**

### THE EVOLUTION CONTINUES

Hydroponic nutrition is in a constant state of evolution. Over the last couple of decades, we have seen our heightened understanding of plant nutrition, how pH affects nutrient uptake and how the relationship between plants and micro-organisms influence the way hydroponic nutrients are designed and used. There are always new technologies or discoveries just around the corner. Although the various hydroponic nutrient manufacturers are competing against each other, they are all inadvertently working together to bring the grower the latest and greatest breakthroughs in plant nutrition. It is not just the manufacturers that play a crucial role in the evolution of hydroponic nutrients. The growers themselves test and experiment with various combinations to find the best nutrient regimen for their individual needs. There is no sole determiner but instead it is the combination of the scientific discoveries, the manufacturers and the growers that together shape the continuous evolution of hydroponic nutrients. **MY**



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# HOW MUCH DOES THIS LIGHT COVER?

**BY CHRISTOPHER SLOPER**

Determining the area a particular grow light covers is more complicated than simply doing the math based on the number of plants you want to grow. Christopher Sloper explains.

As a merchant, one of the most frustrating questions I am asked all the time is, “How much area will this light cover?” Even worse is this question: “How many plants can I grow under this light?” The reason both of these questions are difficult to answer is that there’s a whole lot more to it than just a simple cookie-cutter answer.

I have seen so many different garden lighting configurations over the years that it makes my head spin. Some growers want to see how few lights can be used in their garden space, while others try to cram in as many as they can. Extreme examples range from two 1,000-W lamps on movers covering four 1.2-m by 2.4-m trays to four 1,000-W lamps over a single tray.



“Even when I’m provided with the dimensions of a grow space, it’s still a challenge to recommend a number of lights to cover the space because it can’t all be dedicated to growing plants.”

## Why This Article?

I decided to write this article after receiving the following email from a grower: “I need to know about how much space your 1,000-W fixtures cover. For example, if I had a 275-m<sup>2</sup> warehouse with a 4.26-m ceiling, how many fixtures would I need?”

There are several problems with this question. The total area of a building tells me nothing about how it’s designed. Many configurations can occupy 275 m<sup>2</sup>. Even when I’m provided with the dimensions of a grow space, it’s still a challenge to recommend a number of lights to cover the space because it can’t all be dedicated to growing plants. Aisles are needed as well as access to entrances and exits, plus space for fans, filters and supplies.

Additionally, your arms are only so long. If you plan to access each plant individually, you will need to take this into consideration. Standard trays are as wide as you can reach, assuming you have access to both sides. Any larger and some serious acrobatics might be necessary to maintain the garden.

## Light Levels

Even when you know exactly how much garden space will be illuminated, how much any particular light will cover also depends on what you’re growing as well as the stage of growth. Plants such as wheatgrass require low lumination, whereas tomatoes require much higher levels. Light requirements also vary for each stage of plant growth, from the seedling stage to vegetative growth to the blooming stage. Seedlings and cuttings require the least amount of

illumination while plants in bloom generally require the highest amount of light. Plant light requirements are listed in micromole (μmol) values, not in lumens. Lumens describe the amount of visible light rather than photosynthetically active light, and are used to determine lighting requirements for humans, not plants. Crop requirements in micromoles can be looked up online for various plant crops. Once you have an understanding of how much light your garden needs, you can begin to plan the number and placement of light fixtures. Most manufacturers can provide some basic guidance on the output of their lights.

Ultimately, you will need a quantum meter tuned for the type of light used (HID, induction, LED, etc.) to accurately measure delivered garden illumination when growing in a large, multi-light garden. A quantum meter measures in μmol, the actual number of photons contained within the light striking the surface. Knowing the photon density will allow the gardener to move lights closer together, further apart or up or down, creating better light uniformity and density.

## Too Much Light?

It’s often said bigger is better, but this is not the case with garden lighting.

For many commercially grown plants, scientists have worked out the maximum amount of light a plant can receive on a daily basis. This measurement is called the Daily Light Integral (DLI). Exceeding this amount will cause the plants to defend themselves from the light instead of using it to create valuable sugars for growth. Never exceed DLI values—too much light does not necessarily mean larger harvests and can harm your plants! Be sure and research this factor.

## Do Your Homework

When it comes to how many lights your garden needs, kind of like everything in life, you need to do your own homework. Lighting is the single largest investment in an indoor garden, so you need to make informed decisions. Solely relying on opinions of others, especially anonymous strangers on Internet forums, is not the best method for making this critical decision. Just because someone is having fantastic results in one situation does not automatically mean it will work for you in your situation. Experimentation is required to find the perfect set-up in many cases. So ultimately, how much does “this light” cover? The answer is like that old accounting joke: What do YOU want it to be? **MY**

“How much any particular light will cover also depends on what you’re growing as well as the stage of growth.”

# 10 FACTS ON...HYDROPONIC MEDIA

BY PHILIP MCINTOSH

1. Some sources claim that the hanging gardens of Babylon was the first place where plants were grown without the use of traditional, soil-based methods.
2. Nobody knows for sure how the earliest soilless hydroponic systems worked, but the first hydroponic medium was almost certainly sand (with the possible inclusion of small-sized gravel).
3. There are now at least a dozen different kinds of soilless media applied in hydroponics.
4. Inertness (non-reactivity and having no nutrient value) is usually a desirable feature of hydroponic media. Thus, most media are made from highly stable, inorganic materials.
5. One exception to this inorganic “rule” is coco fibre (coir), which is an organic medium derived from coconuts. Wood chips are another organic medium.
6. Bricks can be recycled into a hydroponic medium when broken up into small pieces. However, depending on where they come from, they could contain contaminants that are detrimental to plant growth.
7. A recent arrival on the recycled media scene is expanded glass. Glass is harvested from refuse collection sites and processed into a light, porous medium similar in appearance to lava rock.
8. Spun mineral fibre (commonly known as stonewool or rockwool) was a successful insulation material for many decades before being adapted for agricultural use.
9. Stonewool was first invented in the 1800s, but it wasn’t adapted for use in agriculture until just after 1970.
10. A root support medium isn’t actually required for hydroponics. Floating bed systems and aeroponics don’t use any media at all.





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**HYALITE KINGSGROVE IS THE NEWEST STORE UNDER THE HYALITE HYDROPONICS UMBRELLA THAT NOW INCLUDES EIGHT LOCATIONS THROUGHOUT AUSTRALIA. THE SHOP IS OPEN LATER TO ACCOMMODATE MORE GROWERS IN THE REGION, AND ITS EXTENSIVE PRODUCT OFFERING IS IMPRESSIVE. THE MANAGER EVEN HELPS CUSTOMERS CREATE CUSTOM LAYOUTS FOR THEIR GROWROOMS, WHICH IS ALL THE MORE REASON TO CHECK THESE GUYS OUT.**

Hyalite Hydroponics has been proudly serving the Australian market for more than 14 years and has recently expanded to eight locations throughout Australia. The group's new Kingsgrove location covers more than 400 m<sup>2</sup> and carries plentiful amounts of the industry's leading brands. Store manager Pete Alkousis has been in the industry for more than seven years and has been an avid gardener for much longer. His wealth of knowledge covers any size of garden and enables him to provide his customers with detailed and informative advice. Setting a great example, Pete inspires his customers and shows them what great growing potential they have.

Hyalite Kingsgrove carries a wide range of international brands, including, but not limited to, Nutrifield, Lucius, EP, Quantus, Grodan, Mountain Air, CANNA, House & Garden, Grotek, Dutch Master, Bloem, Sun Master and GE. With Pete's assistance, the new shop has streamlined its supply chain to eliminate any bottlenecks. This means customers have ready access to exactly what they need, when they need it. On top of the extensive product range, the Kingsgrove store is much more than a retail store where growers simply spend money for products. It has become a place for customers to share information



Pete 1 and Pete 2 are happy to serve you.



## AT A GLANCE

**COMPANY: HYALITE  
HYDROPONICS, KINGSGROVE**

**MANAGER: PETE ALKOUSIS**

**LOCATION: 1/4 WIREGA AVE.  
KINGSGROVE, NSW 2208**

**PHONE: (02) 8068 5896**

**WEB: [HYALITE.COM.AU](http://HYALITE.COM.AU)**

**MOTTO: YOUR ONE-STOP  
HYDROPONIC SHOP**





**HYALITE KINGSGROVE BELIEVES IT IS IMPORTANT TO BE ON A FIRST-NAME BASIS WITH CUSTOMERS TO FOSTER A WELCOMING AND CO-OPERATIVE EXPERIENCE.**

and growing techniques with shop employees and with each other. Hyalite Kingsgrove believes it is important to be on a first-name basis with customers to foster a welcoming and co-operative experience.

Beginner gardeners can go to Hyalite Kingsgrove with their room dimensions and Pete will help customise their room layout, feed chart and equipment list as well as provide instructions on how to use everything. At all Hyalite stores, the most important part of the customers' shopping experience is leaving with a complete understanding of how to use products. "We take all the time customers need so they understand how to maximise their products. Ultimately, customers leave feeling satisfied that they have spent their money wisely and gained knowledge along with their purchases," shares Pete.

Kingsgrove is an attractive, converted-warehouse-style store tucked back from the main road. Pete is there Monday through Saturday and is more than willing to assist with any queries customers have. Hyalite has managed to thrive in Kingsgrove because the shop is open six days a week and keeps the latest hours in the region. This makes it much easier for the working gardener to maintain their stock of supplies and plant food.

Another way in which Hyalite Hydroponics has carved a niche in this growing industry is keeping things simple. "We rely on our greatest asset—our customers," says Pete. Hyalite has become known for

handing out free samples to customers just to gain their feedback. "We only sell what works; we don't sell 'fluff' here. If it hasn't been proven to work, we don't have it on our shelves."

One more way Hyalite has been able to secure a foothold in the area is by listening to customers' ideas and requests. Many of the product lines that have been successful at Hyalite were brought in by word of mouth from customers, explains Pete. One such example is the Nutrifield range of products, of which Hyalite is a premier seller. The nutrients are fabricated from pharmaceutical-grade salts to provide plants with all the essential macro, secondary, micro and organic elements required for plants, ensuring rapid growth and improved yields, as well as top quality for consumers. "Our customers are getting amazing results using this product line and we always recommend it to our organic growers," says Pete.

It is Hyalite Hydroponics' goal to be available to customers as much as possible. The future of the hydroponics industry holds more than can be imagined and Hyalite Hydroponics plans on staying on the cutting edge of what the industry has to offer. As the group of shops continues to rapidly grow and expand, one thing is for sure: the staff plans to always keep that old-style general store atmosphere by making customers feel appreciated and never pressured. **MY**

# MAXIMUM YIELD distributors

Retail Stores are listed alphabetically in each state.

## AUSTRALIA

### ACT

**South Pacific Hydroponics**  
#2 - 84 - 86 Wollongong St.  
Fyshwick ACT 2609  
(02) 6239 2598

**South Pacific Hydroponics**  
70 Oatley Crt.  
Belconnen ACT 2617  
(02) 6251 0600

### NEW SOUTH WALES

**ABC Aquaculture**  
54 Wahrenonga Rd.  
Kanwal NSW 2259  
(61) 2 4393 3131

**ASE Hydroponics**  
Factory 10/45 Leighton Pl.  
Hornsby NSW 2077  
(02) 9477 3710

**Ballina Hydro**  
3 Ray O'Neill Cres.  
Ballina NSW 2478  
(02) 6686 7321

**Brunswick Hydro & Aquarium Supplies**  
19 Booyun St.  
Brunswick Heads NSW 2483  
(02) 6685 1552

**Crisquete Hydroponics and Organics**  
Unit 2/15 Kam Close  
Morisset NSW 2264  
(02) 4973 5779

**Dubbo Hydro & Tobacconist**  
42c Victoria St.  
Dubbo West NSW 2830  
(02) 6885 1616

**Ezi Grow Hydro**  
177 Mt Druit Rd.  
Mt Druit NSW 2770  
(02) 9832 1610

**Ezi Grow Hydro**  
18/340 Windsor St.  
Richmond NSW 2753  
(02) 4588 5826

**Ezi Grow Hydro**  
56 Fish Parade  
Bathurst NSW 2795  
(02) 9832 1610

**Ezi Grow Hydro - Head Office**  
18 Part St.  
Eglington NSW 2795  
(02) 6337 1485

**Favgro Hydroponics Growers**  
107 Glenella Rd.  
Batehaven NSW 2536  
(02) 4472 7165

**Felanza - Hydroponics**  
140 Princess Hwy.  
Arncliffe NSW 2205  
(02) 9556 1494

**General Hydroponics**  
7/14 Sunnyholt Rd.  
Blacktown NSW 9676  
(02) 9676 8682

**Grow Australia**  
Factory 1/5 Sefton Rd.  
Thronleigh NSW 2120  
(02) 9473 5000

**Grow Your Own**  
Unit 6/34 Alliance Ave  
Morisset NSW 2264  
(02) 4973 5179

**Happy Grow Hydro**  
15/The Cres. St.  
Penrith NSW 2750  
(02) 4732 2870

**Home Harvest**  
423 Princess Hwy.  
Rockdale NSW 2216  
(02) 9567 8841

**Hyalite Moorebank**  
6/376 Newsbridge Rd.  
Moorebank NSW 2170  
(02) 9824 3400

**Hyalite Villawood**  
2/21 Birmingham Ave.  
Villawood NSW 2163  
(02) 9723 7199

**Hydro Masta**  
100 Station Rd.  
Seven Hills Sydney NSW 2147  
(02) 8812 2845

**Hydro Masta Pty Ltd**  
76 Beecroft Rd.  
Epping NSW 2121  
(02) 9869 3011

**Hydro Net**  
2/14 Aific St.  
Long Jetty NSW 2261  
(02) 4334 6955

**Hydro Pl.**  
1/68 Nelson St.  
Wallsend NSW 2287  
(02) 4965 6595

**Hydro Shop and Reptile Supplies**  
2/390 The Esplanade  
Warners Bay NSW 2282  
(02) 4958 1489

**Hydro Shop Pty Ltd**  
Unit 1/5-7 Channel Rd.  
Mayfield West NSW 2304  
(02) 4960 0707

**Hydro Supplies**  
57 Flinders St.  
Darlinghurst NSW 2010  
(02) 9326 0307

**Hydro Wise**  
8/385 The Entrance Rd.  
Long Jetty NSW 2261  
(02) 4333 5700

**Hydroponics Grow All Year**  
14 Fitzmaurice St.  
Wagga Wagga NSW 2650  
(02) 6921 5911

**Hygrov Horticulture (Greenlite)**  
252 Oxford St.  
Bondi Junction NSW 2022  
(02) 9369 3928

**Indoor Sun Shop**  
745 Victoria Rd.  
Top Ryde NSW 2112  
(02) 9808 6511

**Indoor Sun Shop**  
Unit 2/109 Junction Rd.  
Moorebank NSW 2170  
(02) 9822 4700

**International Fans**  
PO Box 120  
St. Mary's NSW 2760  
(02) 9833 7500

**Kyper's Tools and Hydroponics**  
Stuart & Tincogan Sts  
Mullumbimby NSW 2482  
(02) 6684 4928

**Lismore Hydro**  
1/106 Canway St.  
Lismore NSW 2480  
(02) 6621 3311

**Lismore Hydroponics**  
Rear of 28 Casino St.  
South Lismore NSW 2480  
(02) 6621 3311

**Northern Lights Hydroponics**  
6/46 Through St.  
South Grafton NSW 2460  
(04) 3110 5882  
growzone@live.com.au

**Northern Nursery Supplies Pty Ltd**  
14-16 Nance Rd.  
Kempsey NSW 2440  
(02) 6563 1599

**Nowra Hydro**  
68 Bridge Rd.  
Nowra NSW 2541  
(02) 4423 3224

**Nutriflo Hydroponic Systems**  
19/5 Daintree Pl.  
Gosford West NSW 2250  
(02) 4323 1599

**Parkview Plants**  
250 Princess Hwy.  
Nowra South NSW 2541  
(02) 4423 0599

**Port Pumps and Irrigation**  
20 Uralla Rd.  
Pt Macquarie NSW 2444  
(02) 6581 1272

**Quik Grow**  
510a Great Western Hwy.  
Pendle Hill NSW 2145  
(02) 9636 7023

**Quick Grow**  
823 King Georges Rd.  
S. Hurstville NSW 2221  
(02) 9546 8642

**Quik Grow Pty Ltd**  
490 Parramatta Rd.  
Petersham NSW 2049  
(02) 9568 2900

**Simple Grow**  
Hassall St. & Windem  
Wetherill Pk NSW 2164  
(02) 9604 0469

**The Grow Shop**  
5/5 Forge Dr.  
Coff's Harbour NSW 2450  
(02) 6651 9992

**Tweed Coast Hydroponics**  
2/58 Machinery Dr.  
Tweeds Head South NSW 2486  
(07) 5524 8588

**Uncle Wal's Gardenland**  
31 Cres. Ave.  
Taree NSW 2430  
(02) 6550 0221

**Home Grown Aquaponics**  
13/8a-8b Hartley Dr.  
Thornton NSW 2322  
(02) 4028 6388

**Westside Lighting & Electrical (Ezi Range)**  
PO Box 274  
Mascot NSW 1400  
1 800 661 475

**Wollongong Hydroponic Center**  
318 Crown St.  
Wollongong NSW 2500  
(02) 4225 8773

### NORTHERN TERRITORY

**Katherine Hydroponics Centre**  
17 Rundle St.  
Katherine NT 0850  
(08) 8972 1730

### QUEENSLAND

**A Happy Medium Hydroponics**  
Unit2/10 Central Crt.  
Browns Plains QLD 4118  
(07) 3809 3322

**Advanced Horticulture Systems P/L**  
Shop 3 11 A Venture Dr.  
Noosville QLD 4566  
(07) 5641 1256

**Allgrow Hydro**  
13 - 58 Bullock Head St.  
Summer Park QLD 4074  
(07) 3376 7222

**Aqua Gardening**  
Shop 3/73 Pickering St.  
Enoggera QLD 4051  
(07) 3354 1588

**Aquatic Oasis**  
Unit 2/33 Smith St.  
Capalaba QLD 4157  
(07) 3245 7777

**Billabong Hydroponics**  
Lot 1 Billabong Crt.  
Childers QLD 4660  
(07) 4126 3551

**D-Bay Hydroponics Shop**  
5/404 Deception Bay Rd.  
Deception Bay QLD 4508  
(07) 3204 8324

**E.T. Grow Home**  
Unit 1/4 Windmill St.  
Southport QLD 4215  
(07) 5591 6501

**Eye Lighting Australia Pty Ltd**  
PO Box 306  
Carole Park QLD 4300  
(07) 3335 3556

**Frans Hydroponics**  
Shed 3 1191  
Anzac Ave. Kallangara QLD 4503  
(07) 3285 1355

**Green Power Hydroponics**  
2/26 Strathvale Crt.  
Caboolture QLD 4510  
(07) 5428 1133

**Grow Hydro**  
22 Mining St.  
Bundamba QLD 4304  
(07) 3816 3206

**H2 Gro Pty Ltd**  
2 Sonia Crt.  
Raceview QLD 4305  
(07) 3294 3253

**Hyalite Varsity**  
5/11 John Duncan Crt.  
Varsity Lakes QLD 4227  
(07) 5593 7385

**Hydroponic Roots & Shoots**  
Lot 3 Herberton Rd.  
Atherton QLD 4883  
(07) 4091 3217

**Hydroponics & Garden Supplies**  
93 Cook St.  
Portsmith QLD 4870  
(07) 4035 5422

**Hydroponics Today**  
PO Box 785  
Stanthorpe QLD 4380  
(07) 4683 3133

**Indoor Solutions**  
Unit 2 / 79 Oxford Tce.  
Taringa QLD 4068

**J&K Hydroponics**  
387 Progress Rd.  
Wacol QLD 4076  
(07) 3271 6210

**KY Garden**  
3/31 Argyle PDE  
Darra Brisbane QLD 4076  
(07) 3375 9098

**Nerang Hydroponic Centre**  
27 Lawrence Dr.  
Nerang QLD 4211  
(07) 5527 4155

**North Queensland Hydro Supplies**  
Shop 28/20-22 Fleming St.  
Townsville QLD 4810  
(07) 4728 3957

**Northern Hydroponics**  
383 Mulgrave Rd.  
Cairns QLD 4870  
(07) 4054 5884

**Pioneer Hydroponics**  
194 Doyleys Rd.  
Pleystowe QLD 4741  
(07) 4959 2016

**Simply Hydroponics Gold Coast**  
42 Lawrence Dr.  
Nerang QLD 4211  
(07) 5596 2250

**Slacks Creek Hydroponics**  
#13/22 Allgas St.  
Slacks Creek QLD 4217  
(07) 3299 1397

**Sunstate Hydroponics**  
10/13 Kerryll St.  
Kunda Park QLD 4556  
(07) 5445 3499

**Tumbling Waters Hydroponics**  
2 Clarkes Track  
Malanda QLD 4885  
(07) 4096 6443

**Walsh's Seeds Garden Centre**  
881 Ruthven St.  
Toowoomba QLD 4350  
(07) 4636 1077

### SOUTH AUSTRALIA



**Advanced Garden Supplies**  
3/8 Bredbo St  
Lonsdale SA 5160  
(08) 8382 1191

**Amazon Aquariums & Gardening**  
Unit 5 16 Research Rd.  
Pooraka SA 5095  
(08) 8359 1800

**Ascot Park**  
753 Marion Rd.  
Ascot Park SA 5043  
(08) 8357 4700

**Barry's Hardware**  
Saints & Main North Rd.  
Salisbury Plains SA 5109  
(08) 8281 4066

**Bolzon Home & Garden**  
103 Tolley Rd.  
St Agnes SA 5097  
(08) 8265 0665

**Chocablock Discount Variety Store**  
15-17/1220 Grand Junction  
Hope Valley SA 5090  
(08) 8396 3133

**Complete Hydroponics**  
1581 Main North Rd.  
Salisbury East SA 5109  
(08) 8258 4022

**Country Hydro**  
434 Saddleback Rd.  
Whyalla SA 5600  
(08) 8645 3105

**D & W Dependable Hardware**  
45B Kettering Rd.  
Elizabeth South SA 5112  
(08) 8287 6399

**Festive Hydro**  
2 Kreig St.  
Evanston Park SA 5116  
(08) 8523 5100

**Fulham Gardener Nursery**  
597 Tapleys Hill Rd.  
Fulham SA 5024  
(08) 8235 2004

**Futchatec Distribution**  
4 Symonds St.  
Royal Park 5014  
(08) 8447-1122

**Glandore Hydroponics**  
644 - 646 South Rd.  
Glandore SA 5037  
(08) 8371 5777

**Greener than Green**  
52 - 54 Cliff Ave. Port Noarlunga  
South SA 51  
(08) 8386 2596

**Greenhouse Superstore Lonsdale**  
35 to 37 Aldenhoven Rd.  
Lonsdale SA 5160  
(08) 8382 0100

**Greenhouse Superstore Royal Park**  
4 Symonds St.  
Royal Park SA 5014  
(08) 8447 5899

**Ground-Up Service Nursery**  
3 Copinger Rd.  
Pt. Pirie SA 5540  
(08) 8264 9455

**Harvest Time Hydroponics**  
Shop 3/146-148  
Findon Rd. Findon SA 5023  
(08) 8244 0222

**Hindmarsh Hydroponics**  
39a Mantion St.  
Hindmarsh SA 5095  
(08) 8346 9461

**Highland Grow & Flow**  
14/1042 Grand Junction Rd.  
Holden Hill SA 5088  
(08) 8395 4455

**Hong Kong Hydro**  
13 Research Rd.  
Pooraka SA 5095  
(08) 8260 2000

**Hydro Heaven**  
Kane Motors-Hunt Rd.  
Mount Barker SA 5251  
(08) 8391 1880

**Hydro Sales & Service**  
1 Salisbury Cres.  
Colonel Light SA 5041  
(08) 8272 2000

**Hydro Technics**  
321 South Rd.  
Croydon SA 5008  
(08) 8241 5022

**Hydro Warehouse**  
181 Seacombe Rd.  
South Brighton SA 5048  
(08) 8377 1200

**Hydro World**  
40 Folland Ave.  
Northfield SA 5085  
(08) 8262 8323

**Koko's Hydro Warehouse**  
Unit 2/2 McGowan St.  
Pooraka SA 5095  
(08) 8260 5463

**Larg's Bay Garden Supply**  
239 Victoria Rd.  
Largs Bay SA 5016  
(08) 8242 3788

**Martins Rd. Hydro**  
# 5- 353 Martins Rd.  
Parafind Gardens SA 5107  
(08) 8283 4011

**Mitre 10 Dr. In**  
152 Hanson Rd.  
Mansfield Park SA 5012  
(08) 8445 1813

**New Age Hydroponics**  
135-137 Sir Donald Bradman Dr.  
Hilton SA 5033  
(08) 8351 9100

**Owen Agencies**  
17-19 Railway Terr.  
Owen SA 5460  
(08) 8528 6008

**Palms & Plants**  
175 Salisbury Hwy.  
Salisbury SA 5108  
(08) 8285 7575

**Professional Hydro**  
4/522 Grange Rd.  
Fulham Gardens SA 5024  
(08) 8353 0133

**Professional Hydro**  
Shop 5/645 Lower North East Rd.  
Paradise SA 5075  
(08) 8365 5172

**Professional Hydroponics**  
113 Maurice Rd.  
Murray Bridge SA  
(08) 8532 3441

**Seaton Hydroponics**  
129 Tapleys Hill Rd.  
Seaton SA 5023  
(08) 82682636

**Soladome Aquaculture & Hydro**  
44 Chapel St.  
Norwood SA 5067  
(08) 8362 8042

**South Coast Hydroponics**  
6/25 Guilfvie Rd.  
Christies Beach SA 5165  
(08) 8384 2380

**State Hydroponics**  
174 Semaphore Rd.  
Exeter SA 5019  
(08) 8341 5991



**Tea Tree Gully Hydro**  
32 Famechon Cres.  
Modbury North SA 5092  
(08) 8264 9455

**Two Wells Hardware**  
86 Old Port Wakefield Rd.  
Two Wells SA 5501  
(08) 8520 2287

**Urban Grow Solutions**  
1/111 Main St Rd  
O'Halloran Hill, S.A. 5189  
(08) 8322 0040

**West Garden Centre**  
Peachey Rd.  
Elizabeth West SA 5113  
(08) 8255 1355

## TASMANIA

**Advanced Hydroponics**  
26 Mulgrave St.  
South Launceston Tas 7249  
(03) 6344 5588

**Aqua Hydroponics**  
Rear 45 Burnett St.  
New Norfolk Tas 7140  
(03) 6294 9233

**Ezy Grow**  
625 East Derwent Hwy.  
Lindisfarne Tas 7015  
(03) 6243 9490

**Garden World**  
717 West Tamar Hwy.  
Legana Tas 7277  
(03) 6330 1177



**Green Acres Hydroponics**  
46-48 Binalong Rd.  
Mornington, TAS 7018  
(03) 6245 1066  
sales@greenacreshydroponics.com.au

**Growers Choice**  
225 Main Rd.  
Derwent Park Tas 7009  
(03) 6273 6088

**Hydroponics Systems**  
131 Main Rd.  
Moonah, Tas 7009  
(03) 6278 3457

**Hydroponic World**  
322 Bass Hwy.  
Sulphur Creek Tas 7316  
(03) 6435 4411

**Lifestyle Gardens**  
167 Gilbert St.  
Latrobe TAS 7307  
(03) 6426 2003

**Organic Garden Supplies**  
17 Don Rd.  
Devonport Tas 7310  
(03) 6424 7815

**Tas Hydroponic Supplies**  
99 Lampton Ave.  
Derwent Park Tas 7009  
(03) 6272 2202

**The Hydroponic Company**  
69 Charles St.  
Moonah Tas 7009  
(03) 6273 1411

**The Hydroponics Company**  
289 Hobart Rd.  
Kings Meadow Tas 7428  
(03) 6340 2222

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COMING UP  
NEXT ISSUE



## COMPOST TEAS THAT PLEASE

Compost tea is simply the stewing of aged compost in water for about three days. It is a safe, non-burning, low-strength fertiliser that naturally improves the biodiversity of the soil structure and the delivery of micronutrients to plants, and it's also easy to make.

## WHAT IS N-P-K ALL ABOUT?

N-P-K stands for nitrogen (N), phosphorus (P) and potassium (K). These are the elements that get most of the attention when it comes to plant nutrition since all three are used in large quantities by plants.

## METERS & TESTS GET THINGS RIGHT

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